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**BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES  
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**



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APPELLANT: Bart F. Rice ✓  
SERIAL NO.: 09/759,425 ✓  
FILING DATE: January 12, 2001 ✓  
TITLE: Spread Spectrum Electromagnetic Signals ✓  
EXAMINER: Salvatore Cangialosi  
GROUP ART UNIT: 2661  
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**CERTIFICATE OF MAILING**

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Dated: July 10, 2002

By: Edward J. Radlo

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Box Appeal  
Commissioner for Patents  
Washington, D.C. 20231

**APPEAL BRIEF**

**1. Real Party in Interest**

The real party in interest is the assignee, Lockheed Martin Corporation.

**2. Related Appeals and Interferences**

The parent of this application (U.S. serial no. 08/003,996 filed January 15, 1993) was previously twice appealed to the Board of Patent Appeals and Interferences.

In the first appeal, the Board issued its decision on March

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24, 1999, affirming the Examiner's final rejection. The claims were subsequently amended and a second appeal was filed on March 9, 2001. A decision from the Board on the second appeal is currently pending.

A related application (U.S. serial no. 08/456,077 filed May 31, 1995) having the same inventor and same assignee was appealed to the Board of Patent Appeals and Interferences. The appeal brief in that case was filed on December 22, 1997. After the appeal brief was filed, the Examiner indicated that he would allow two of the four claims that were appealed if the appeal were withdrawn. That in fact happened, and that application matured into U.S. patent 5,815,526. The two claims that were not allowed were made the subject of a divisional application (U.S. serial no. 09/113,410 filed July 10, 1998), which application also matured into an issued patent: U.S. patent 5,991,333.

### **3. Status of Claims**

Claim 1 was canceled. Claims 2 through 19 are pending and stand rejected. Claims 2 through 19 are being appealed.

### **4. Status of Amendments**

Amendment C Under Rule 116(b) was filed on February 13, 2002. Said Amendment incorporated a suggestion by the Examiner that the signals be confined within a spread

spectrum system. In his Advisory Action mailed March 6, 2002, the Examiner nevertheless refused to enter the amendment and maintained his rejection of all claims.

## **5. Summary of Invention**

The present invention is an assembly of simultaneously transmitted electromagnetic signals (the outputs of Figs 1-10). Page 25 lines 12-17; page 29 lines 5-12; page 31 line 5 through page 32 line 5; page 35 line 19 through page 36 line 9. The electromagnetic signals are related to each other in said assembly to communicate information to a receiver (Fig. 11). Page 12 lines 16-22; page 36 lines 10-30. The electromagnetic signals are structured to contain corresponding subsets of a set of binary spreading-code sequences (the outputs of items 10 and 11); each subset of said set of binary spreading-code sequences embodies a corresponding portion of said information. Page 10 lines 2-11; page 12 lines 3-15; page 13 line 21 through page 14 line 32.

## **6. Issues**

The pending claims are rejected under 35 U.S.C. §101 and 35 U.S.C. §103.

## **7. Grouping of Claims**

Apparatus claims 2 and 5-12 arguably stand together. Product-by-process claims 3, 13, and 14 arguably stand

together. Product-by-process claims 4 and 15-19 arguably stand together.

## 8. Argument

### Rejection under 35 U.S.C. §101

The Examiner rejected claims 2-19 under 35 U.S.C. §101 as being drawn to non-statutory subject matter. Examiner Office Action, paper number 7, page 2. The Examiner asserted that signals, as claimed, fall outside the scope of patentable subject matter as defined by 35 U.S.C. §101.

The Federal Circuit addressed whether a signal may be considered patentable subject matter under 35 U.S.C. §101 in Arrhythmia Research Technology v. Corazonix, 22 USPQ 2d 1033 (CAFC 1992). The case involved a device that identified heart attack victims that had a high risk of suffering severe heart arrhythmia after their heart attacks. This device received an electrical analog signal relating to heart activity from an electrocardiographic device attached to a patient's chest. This analog signal was converted to a digital signal and later analyzed to determine patients at risk of developing heart arrhythmia. The court stated:

"These input signals are not abstractions; they are related to the patient's heart function."

Arrhythmia, supra, at page 1038.



"The resultant output is not an abstract number, but is a signal related to the patient's heart activity." Arrhythmia, supra, at page 1038.

"These claimed steps of 'converting', 'applying', 'determining', and 'comparing' are physical process steps that transform one physical, electrical signal into another. The view that 'there is nothing necessarily physical about 'signals'' is incorrect. In re Taner, 681 F.2d 787,790, 214 USPQ 678,681 (CCPA 1981)." Arrhythmia, supra, at page 1038. State Street Bank & Trust v. Signature Financial Group, 47 USPQ 2d 1596 (1998).

The Court of Appeals for the Federal Circuit characterized the Arrhythmia invention (transformation of a particular input signal to a different output signal) as the conversion of one concrete, tangible, physical thing into another concrete, tangible, physical thing, favorably citing In re Sherwood, supra. Arrythmia, supra, at page 1039.

The Examiner also asserted that the claimed electromagnetic signals are disembodied from a medium. Examiner Office Action, paper number 7, page 3. However, the concrete, physical nature of the claimed electromagnetic signals allows them to be measured, detected, and sensed. In fact, it is this characteristic that allows the spread spectrum system to function. Spreading codes and data used to generate the signals are stored within both the

transmitting node and receiving node. When transmitted, the signals propagate through the air, allowing for physical detection and identification of both the data and spreading codes comprising the signal. Accordingly, the signals are not disembodied from a medium; rather, they are embodied within a medium that facilitates both the propagation and detection of the data and the spreading codes within the signal.

The Examiner also suggested that restriction to a system or element of a process may make the claims patentable. Examiner Office Action, paper number 7, page 5. The claimed electromagnetic signals are produced by a process defined within the claims. Specifically, each claim recites physically stored spreading-code sequences and stored information used to create an assembly of spread spectrum signals. The stored sequences and information are combined within a memory device and modulated onto a sinusoidal electromagnetic carrier (claims 2 and 5-12). The resulting assembly of signals is transmitted onto a multi-node network where specific signals are received by particular receiving nodes. Both the sequences and information on these signals are also stored within the particular receiving nodes.

The claims identify the processes by which the signals are generated, transmitted, and received. Each of these steps is a physical process (i.e. storing, combining,

modulating, and generating) that transforms a physical signal into another physical signal.

The Examiner asserted that "Once a signal has left a transmitter, nothing in that signal can tie it to a specific process or apparatus out of the plurality of processes or apparatuses which could have produced it, hence those limitations are meaningless." Examiner Office Action, paper number 7, page 2. Appellant respectfully disagrees. The inherent relationship between spread spectrum signals and transceivers is precisely the reason why spread spectrum is able to function properly. Specifically, the data stored at a transceiver allows a spread spectrum signal to be properly transmitted and correctly recognized at a corresponding receiver. Thus, this relationship not only ties the transceiver to the signal, but is also pivotal to the operation of a spread spectrum system. As such, Appellant is claiming a signal tied to the physical processes in which it was created and transmitted.

The Examiner alleged: "Any signal in free space is transitory, ephemeral and not useful without transmission or reception." Examiner Office Action, paper number 7, page 3. However, at the Partners in Patents V Conference, Stephen G. Kunin, then Deputy Assistant Commissioner of the USPTO for Patent Policy & Projects, spoke publicly about signals being statutory under 35 U.S.C. §101. Stephen G. Kunin, "Computer Program Product Claims", Presentation at Partners in Patents V Conference. The conference occurred in the U.S. sometime

between October 22, 1996 and May 18, 2000. Three copies of the Microsoft Powerpoint version of this presentation are enclosed. The Kunin presentation states:

"Signal claims are:

--Manmade and tangible in sense that they can be

--Sensed

--Measured

--Put to useful purpose

--Meet Supreme Court's definition of  
manufacture".

Kunin, supra, at page 14.

Additionally, the presentation states:

"Signal claims are:

--Just as much computer elements as software

--Much like other computer elements routinely  
patented". Id. at page 16.

Mr. Kunin's position has been supported by other Examiners who have issued patents containing signal claims. In fact, there are two United States patents, commonly-assigned with the present patent application, that have issued, in which the claims are broader in a 35 U.S.C. §101 sense than the claims of the present application: U.S. patent 5,815,526 and U.S. patent 5,991,333.

Each of the two claims of said U.S. patent 5,815,526 recites simply a "signal comprising a set of binary spreading-code sequences modulated onto a sinusoidal carrier..." On the other hand, all of the claims of the

present invention are restricted to electromagnetic signals -- an "assembly of simultaneously transmitted electromagnetic signals" in claims 2, 3, 5-14 and an "assembly of electromagnetic signals" in claims 4, 15-19. Note that claims 2 and 5-12 of the present application recite modulation onto a sinusoidal carrier, precisely the recitation found to be within 35 U.S.C. §101 by the Examiner of said patent 5,815,526.

Similarly, all of the claims of said U.S. patent 5,991,333 are directed to simply a "signal comprising a set of binary spreading-code sequences, said set of binary spreading-code sequences being produced by a process of . . . ." Said claims are not limited to electromagnetic signals, whereas all the claims of the present application are limited to electromagnetic signals.

The Kunin presentation cites the issuance of U.S. patent 5,568,202 to Koo, entitled "System for Echo Cancellation Comprising an Improved Ghost Cancellation Reference Signal". Kunin, supra, at pages 8-9. The first claim of the Koo patent reads:

"1. An electronic reference signal in a system for minimizing the effects of ghosts occurring during the transmission and reception of a television signal over a communications path, wherein said reference signal is embodied in a processor readable memory, is non-cyclic,

has a substantially flat frequency response within the bandwidth of said communications path and has a plurality of substantially uniform amplitude peaks over a time interval, and wherein a replica of said reference signal is transmitted as part of said television signal and is utilized by a decoder to derive coefficients which are used with at least one filter to remove said ghosts." (emphasis added)

As previously discussed, Appellant's claims highlight the functional relationship between the signals and the binary spreading-code sequences stored in memory devices (e.g., shift registers) within the transmitting node of the present invention. Specifically, the signals are an analog replica of digital data stored within the shift registers. As is the case in patent 5,568,202 to Koo, the resulting analog signal is generated from stored binary data within a memory device. The Kunin presentation relates the prosecution history of the Koo patent. Initially, the Examiner and the Board of Patent Appeals and Interferences rejected the signal claims. Subsequently, the inventor appealed to the U.S. Court of Appeals for the Federal Circuit, which remanded the case back to the PTO allowing the claims to be amended to incorporate the signal in a computer readable memory. Thereafter, the application issued.

The Board is asked to construe 35 U.S.C. §101 in the enlightened manner demonstrated by the Examiners of U.S. patents 5,815,526, 5,991,333, and 5,568,202.

The Court of Appeals for the Federal Circuit, in State Street Bank & Trust v. Signature Financial Group, 47 USPQ 2d 1596 (1998), cert. denied, held that any process, machine, manufacture or composition of matter employing a law of nature, natural phenomenon, or abstract idea is patentable subject matter as long as a useful, concrete, and tangible result is produced. The Examiner has not disputed that the present claims incorporate a useful result. And the result is clearly concrete and tangible, as more fully discussed below. Therefore, the present claims are clearly patentable under the State Street doctrine.

The Examiner has alleged that there is no authority holding that transitory emanations can be patentable. Examiner Office Action, paper no. 7, at page 3. To the contrary, the Kunin presentation states:

"Signal claims are:

--No more ephemeral than element 95 patented in 1964

--Seaborg patent

--U.S. Patent Number: 3,156,523".

Kunin, supra, at page 10.

Mr. Kunin's opinion is supported by the U.S. Court of Customs and Patent Appeals in In re Gyurik, 201 USPQ 552

(CCPA 1979), where the court reversed an obviousness rejection where "the present obviousness rejection is based solely upon the 'status' of the claimed compounds as intermediates in the production of end products specifically named in the prior art." 201 USPQ at 557. An "intermediate" compound in the chemical arts is analogous to a fast-moving assembly of electromagnetic signals as claimed herein. Additionally, in In re Breslow, 205 USPQ 221 (CCPA 1980), the court stated: "It appears to us that the PTO would read into §101 a requirement that compositions of matter must be stable -- which is a relative term to say the least. We see no good reason to do so. It would appear that many compounds may find their greatest or even their sole utility in the fact that they are not stable." 205 USPQ at 226.

Furthermore, the Examiner's assertion that the transitory nature of signals renders them unpatentable creates an erroneous patentability standard. All manufactures, structures and devices are transitory (i.e., they decay over time). For example, even the pyramids in Egypt and Sudan are transitory because they will eventually decay. Thus, the Examiner is trying to set a threshold time period that an invention must exist in order to be patentable. However, such a standard has no foundation within the existing patent statutes, rules, or procedures.



The claims as presently amended now clearly pass muster under 35 U.S.C. §101. Both the majority and the minority opinions of the Board of Patent Appeals and Interferences, in their Decision on Appeal (dated March 24, 1999) in the parent (U.S. serial no. 08/003,996 filed January 15, 1993) to the instant patent application, suggested that if the claims were limited to "electromagnetic" signals, they would be patentable. For example, the majority opinion stated, on page 18: "It is true that electromagnetic signals are characterized by variations of electric and magnetic fields and have a physical existence that is capable of being detecting [sic]. However, the claims do not recite an electromagnetic signal . . ." Similarly, the minority opinion by Administrative Patent Judge Torczon stated, on page 25: "We need not assume that a signal is an electromagnetic wave if the language of the claim does not require that construction. . . . The claims on appeal do not require the signal to be an electromagnetic wave (or some sort of particle for that matter). . . . Appellant misses both of the safe harbors afforded under the case law: a firm linkage to physical elements or a firm linkage to a specific practical use."

The explicit recitation of the word "electromagnetic" in all of the present claims as amended gives this "firm

linkage to physical elements" that Judge Torczon was looking for.

Electromagnetic signals are real; they are concrete, tangible, and physical. They are particles as well as waves. Einstein was able to explain all the features of the photoelectric effect by assuming that light (part of the electromagnetic spectrum) acted like quantized particles. Einstein's explanation was so compelling and its influence so far reaching that it won him the 1921 Nobel Prize for physics. Jones, Physics for the Rest of Us (Contemporary Books, Inc. 1992), page 143; three copies enclosed. The wave-particle duality is a basic feature of nature, and whether light or another part of the electromagnetic spectrum needs to be described as a particle or as a wave depends on the nature of the experiment being performed. Brennan, Dictionary of Scientific Literacy (John Wiley & Sons, Inc. 1992), page 324; three copies enclosed.

The four statutory classes of invention are any new and useful process, machine, manufacture, or composition of matter. The Examination Guidelines for Computer-Related Inventions characterize these categories by stating that "the latter three categories define "things" while the first category defines "actions" (i.e., inventions that consist of a series of steps or acts to be performed)." Examination Guidelines for Computer-Related Inventions, Final Version,

Part IV: Determine Whether the Claimed Invention Complies with 35 U.S.C. §101, <http://www.uspto.gov/web/offices/com/hearings/software/analysis/computer.html>, downloaded on September 26, 2000. Three copies of the Examination Guidelines, as downloaded, are enclosed.

The U.S. Supreme Court, in discussing the legislative history of 35 U.S.C. §101, stated that: "The Committee Reports accompanying the 1952 act inform us that Congress intended statutory subject matter to 'include anything under the sun that is made by man.'" Diamond v. Chakrabarty, 206 USPQ 193,197 (S.Ct. 1980).

Furthermore, the U.S. Supreme Court has held that: "In choosing such expansive terms as 'manufacture' and 'composition of matter,' modified by the comprehensive 'any,' Congress plainly contemplated that the patent laws would be given wide scope." Diamond v. Chakrabarty, supra, at page 197.

Deller's Walker on Patents (Second Edition), Vol. 1, page 123, Section 17, states that:

"...the term 'manufacture' embraces whatever is made by the art of industry or man but excludes processes, machines and compositions of matter."

Accordingly, the term "manufacture" embraces any man-made thing that is not embraced by the other statutory classes of invention -- viz., processes, machines and

compositions of matter. Deller's Walker on Patents (Second Edition), Vol. 1, page 124, Section 17, refers to the Oxford English Dictionary (1934 Edition) for a concise definition of a "manufacture" as a product of physical labor or machinery. The present claims fit within the definition of "manufacture".

The present claims also fit within the definition of "composition of matter". The Court of Customs and Patent Appeals, in discussing whether an invention was a "manufacture" or a "composition of matter", held that: "This is not a matter of great moment since there is considerable overlap between these two broad categories.... If it is either, it is statutory subject matter, and it is not intellectually profitable to attempt a distinction in this regard." In re Bergy, 195 USPQ 344,348 (CCPA 1977).

In the same case, the Court of Customs and Patent Appeals stated that: "We cannot agree... that §101 'must be strictly construed.'... We have never heard of a case holding that the categories of patentable subject matter, as enumerated in §101 or any of its predecessor statutes, should be strictly construed and the board has cited none." In re Bergy, supra, at page 350.

An assembly of electromagnetic signals as defined by claims 2 through 19 is clearly man-made, and therefore constitutes a "manufacture" in the sense of 35 U.S.C. §101. The product-by-process format of claims 3, 4, and 13 through

19 explicitly indicates that the claimed assembly of electromagnetic signals is produced (i.e., a man-made product), and hence is a concrete, tangible manufacture. Accordingly, Appellant submits that claims 2 through 19 define subject matter within at least one of the statutory classes of invention.

The Examiner has not cited any authority (e.g., case law, or even a published policy statement by the Patent and Trademark Office) in support of his assertion that electromagnetic signals are not patentable.

Additional support for Appellant's conclusion that electromagnetic signals (if properly claimed) are within the scope of patentable subject matter is found in a number of additional cases decided by the Court of Customs and Patent Appeals (CCPA) and its successor court, the Court of Appeals for the Federal Circuit (CAFC).

In In re Johnson, 200 USPQ 199 (CCPA 1978), the court considered three consolidated appeals from decisions of the Patent and Trademark Office Board of Appeals in which certain method claims had been rejected for allegedly being directed to nonstatutory subject matter. In one of the appeals in Johnson, the Board had upheld the rejection of certain method claims for converting "noisy" signals (viz., seismic traces) into noiseless signals. In reversing the Board's decision, the court stated with respect to the noiseless signals that:

"The products produced by applicants' claimed processes are new, noiseless seismic traces recorded on a record medium and not mere mathematical values. Thus, the significant limitations recited in the claims of operating on a recorded, unenhanced, seismic trace to produce and record a new seismic trace lead us to find the claims to recite statutory processes and not methods of calculating." In re Johnson, supra, at pages 207-208.

The court also stated with respect to the above-mentioned noiseless signals that:

"... claim 1 recites 'a selected seismic trace R' having 'a coherent signal component' and 'a noise component' indicative of a noise event. One or more 'additional traces' are chosen which also contain the coherent signal component. The coherent signal (the reference signal without the noise component) is determined and reproduced on an 'output signal record medium' in place of the reference trace. Even assuming arguendo that the 'computing' step recited in the claim entails performing mathematical calculations, the process is explicitly claimed within the framework of a method for producing an output seismic trace which is different from, and an enhancement of, an input seismic trace." In re Johnson, supra, at page 209.

In a second one of the appeals in Johnson, the Board had similarly upheld the rejection of certain method claims. In reversing the Board's decision, the court stated with respect to the first claim that:

"... the claim when analyzed in its entirety still defines a process for producing a segment of a seismic trace, which is free from a multiple noise event, from a segment of a trace which includes the multiple noise event. Thus, while the steps recited in the claim may include the execution of a mathematical procedure, it is clear that the claim as a whole defines a sequence of steps for operating upon a seismic data trace to produce a different, noise-free seismic data trace." In re Johnson, supra, at page 210.

In a third one of the appeals in Johnson, in which the Board had likewise rejected certain method claims, the court in reversing the Board's decision stated that:

"... it is clear that any mathematical operations performed in practicing the processes are incidental to the recited series of steps whereby a seismic data record is analyzed and processed in a specific manner to produce and record a noiseless seismic data record." In re Johnson, supra, at page 210.

In Johnson, the applicants apparently did not present any product-by-process claims directed to signals; the

question before the court was limited to the allowability vel non of method claims directed to processes for producing seismic signals. There is no statement in Johnson as to why product-by-process claims directed to signals were not submitted. However, it should be appreciated that at the time of the Johnson case, it was difficult to obtain allowance even for method claims involving mathematical algorithms. "It was the board's position that *Gottschalk v. Benson*..., 175 USPQ 673 [S. Ct.] 1972), and *In re Christensen*..., 178 USPQ 35 (CCPA 1973), preclude a patent grant for any 'subject matter which is algorithmic in character'." In re Johnson, supra, at page 205. In any event, the claims in Johnson are broader in a 35 U.S.C. §101 sense than the claims of the present invention.

The court in Johnson was concerned only with method claims. Nevertheless, in reversing the Board of Appeals on the issue of the allowability of the method claims, the court in Johnson clearly indicated that the signals produced by the processes (as defined by the method claims) were indeed physical entities -- and were not merely mental constructs. The court in Johnson explicitly characterized the signals as "products produced by applicants' claimed processes".

In In re Sherwood, 613 F.2d 809,819, 204 USPQ 537,546 (CCPA 1980), cert. denied, 450 U.S. 994, 210 USPQ 776 (1981), the court held with respect to certain method claims that:



"Each of the claim preambles recites a system for converting a 'seismic time section consisting of \*\*\* amplitude-versus-time seismic traces' (these seismic traces are electrical signals from geophones, i.e., physical apparitions, or particular patterns of magnetization on magnetic tape, i.e., the pattern of the magnetization being a physical manifestation, or a physical line on a paper chart) into a 'seismic depth section consisting of amplitude-versus-depth traces' (a subterranean cross-sectional map). The claimed invention, contrary to the solicitor's arguments, converts one physical thing into another physical thing just as any other electrical circuitry would do." In re Sherwood, supra, at page 546.

The court in Sherwood held that the electrical signals produced by the claimed method are concrete, tangible, physical things -- and not merely mental constructs.

In In re Taner, 214 USPQ 678 (CCPA 1982), the court held with respect to certain method claims that:

"Though the board conceded that appellants' process includes conversion of seismic signals into a different form, it took the position that 'there is nothing necessarily physical about 'signals'' and that 'the end product of [appellants' invention] is a mathematical result in the form of a pure

number.' That characterization is contrary to the views expressed by this court in In re Sherwood... and in In re Johnson, where signals were viewed as physical and the processes were viewed as transforming them to a different state." In re Taner, supra, at page 681.

In Johnson, Sherwood, Taner, and Arrhythmia, the process whereby the claimed signals are produced was found to be statutory. Appellant submits that the reasoning of the courts in Johnson, Sherwood, Taner, and Arrhythmia with respect to electrical and seismic signals (viz., that the signals are concrete, tangible, physical things produced by the claimed process) is likewise pertinent to the electromagnetic signals of the present patent application.

In accord with the reasoning in Johnson, Sherwood, Taner, and Arrhythmia, the electromagnetic signals produced by the processes as defined by the product-by-process claims 3, 4 and 13-19 of the present patent application must necessarily be considered as physical things. Product-by-process claims were not presented in Johnson, Sherwood, Taner, and Arrhythmia, so the full implication of the nature of signals as physical things was not an issue -- in terms of statutory subject matter -- in those earlier cases. However, Appellant submits that if product-by-process claims had been presented in Johnson, Sherwood, Taner, and Arrhythmia, the court would have found such claims to be

allowable because of: (1) the allowability of the underlying processes, and (2) the physical reality of the signals produced by the processes, as expressly stated by these courts.

Appellant submits that in the absence of any authority supporting the Examiner's assertion that electromagnetic signals are outside the four statutory classes of invention, and in view of the authority cited by Appellant indicating that the assemblies of electromagnetic signals as recited in claims 2 through 19 are concrete, tangible, physical things, the Examiner is constrained to treat the electromagnetic signals of the present application as statutory subject matter (whether manufactures or compositions of matter) within the intendment of 35 U.S.C. §101.

The Examiner, paraphrasing what he said in his Final Office Action mailed May 19, 1994 in the grandparent patent application (U.S. Patent No. 5,210,770), stated that: "Further certain of the claims, e.g. claim 8, attempt to tie these emanation [sic] to a specific process or apparatus. Once a signal has left a transmitter, nothing in that signal can tie it to a specific process or apparatus out of a plurality of processes or apparatuses which could have produced it. . ." Examiner's Response, paper no. 7, at page 2.

With regard to the product-by-process claims (claims 3,4 and 13-19) as presently amended, the above-quoted

remarks of the Examiner are inapposite. Assuming arguendo that it would not be possible to tell -- from the assembly of electromagnetic signals alone -- how the electromagnetic signals (i.e., the product) were produced, a person detecting the assembly of electromagnetic signals might not be able to ascertain whether the producer of the electromagnetic signals necessarily infringed the product-by-process claims 3, 4 and 13-19 in producing the electromagnetic signals. However, Appellant submits that any perceived difficulty in ascertaining whether a product-by-process claim has been infringed is irrelevant to allowability of the product-by-process claim.

Infringement of a product-by-process claim directed to an assembly of electromagnetic signals would be established by evidence. The nature of such evidence would depend upon the circumstances of the particular case. Evidence as to how the assembly was produced could be provided by, e.g., testimony of the person who transmitted the assembly, or sales literature published by the entity that transmitted the assembly.

Evidence as to how an assembly of electromagnetic signals was produced might actually be apparent from the assembly itself. An assembly of electromagnetic signals in free space having attributes as described in the present patent application might reasonably be determined to have been produced by the underlying process, because there might

be no other process presently available whereby such an assembly could feasibly be produced. In any event, such considerations go to the issue of proving infringement of the product-by process claims, rather than to the issue of the allowability of such claims.

It is true (and desirable from the standpoint of security) that an "eavesdropper" who detects an electromagnetic signal in free space might not be able to ascertain -- from the electromagnetic signal itself -- the source (i.e., the producer) of the electromagnetic signal. However, within a multi-node communication network such as that to which the instant invention finds applicability, each node of the network would be able to identify -- from attributes of the electromagnetic signals themselves -- those particular electromagnetic signals produced by any other node of the network. Also, within the network, each node would recognize how the electromagnetic signals produced by the other nodes of the network are produced. Within the network, each node would readily associate the electromagnetic signals produced by the other nodes with the process and apparatus used to produce the electromagnetic signals.

The Examiner, paraphrasing what he said in his Final Office Action mailed May 19, 1994 in the grandparent patent application (which matured into U.S. Patent No. 5,210,770), further stated that: "This attempt to patent signals in

free space is akin to patenting an audio or television program or **any other signal** in free space after transmission but before reception." Examiner's Office Action, paper no. 7, at page 2.

Thus, the Examiner has taken the position that a patent on assemblies of signals would be analogous (the Examiner's word is "akin") to a patent on an audio program or a television program.

The Examiner's rationale for rejecting the present claims seems to be expressible in roughly syllogistic form as follows:

Major Premise: Audio programs and television programs are nonstatutory.

Minor Premise: Assemblies of signals as defined by the present claims are identifiable (for purposes of construing 35 U.S.C. §101) -- at least in an analogous sense -- with audio programs and television programs.

Conclusion: Therefore, assemblies of signals as defined by the present claims are nonstatutory.

Appellant submits that there is an error in this conclusion, because the minor premise of the syllogism is fallacious.

There is a fallacy in identifying assemblies of electromagnetic signals as defined by the present claims with an audio program or television program. Assemblies of

electromagnetic signals as claimed are perhaps analogous (and hence "identifiable" for the purpose of reasoning by analogy) to a medium in which an audio program or a television program is fixed. More specifically, assemblies of electromagnetic signals as claimed are analogous to a magnetic tape or laser disk in which an audio program or television program is recorded. However, the medium in which the audio program or television program is fixed (the magnetic tape or laser disk) is not the audio program or the television program. A medium used for conveying information is not the same as the information that is conveyed.

A copyright can be obtained for information that is fixed in any tangible medium of expression. The statute defining copyrightable subject matter, 17 U.S.C. §102, provides in pertinent part that:

"(a) Copyright protection subsists... in original works of authorship fixed in any tangible medium of expression... from which they can be perceived, reproduced, or otherwise communicated, either directly or with the aid of a machine or device...."

However, a copyright protects only the information (i.e., the original work of authorship), and not the tangible medium of expression in which the information is fixed.

An audio program or a television program is a "work of authorship" in the copyright sense. Thus, a copyright can preclude someone else from reproducing a particular sequence of sounds that constitutes an audio program. However, a copyright on an audio program does not preclude someone else from manufacturing the magnetic tape upon which such a sequence of sounds can be recorded, or from manufacturing a laser disk upon which a television program can be recorded. A novel magnetic tape or laser disk constitutes statutory subject matter for a patent.

The fact that an audio program can be copyrighted does not preclude patentability of a concrete, tangible medium (e.g., a novel kind of magnetic tape) in which the audio program is fixed. The fact that an audio program (or any other type of information that is statutory subject matter for a copyright) can be written or otherwise impressed on a magnetic tape or laser disk, establishes the "usefulness" of the tape or disk as specified in 35 U.S.C. §101 as a condition for patentability of the tape or disk.

An assembly of electromagnetic signals according to the present invention consists of a plurality of spreading-code sequences, which have specified properties. The electromagnetic signals may or may not contain information during any given time interval. The electromagnetic signals can exist independently of whether any information is contained therein, just as a magnetic tape can exist



independently of whether any information is recorded thereon.

Patent protection (as sought in the present patent application) for assemblies of electromagnetic signals as claimed would preclude others from producing such electromagnetic signals, but would not prevent others from transmitting any particular information. If Appellant were to transmit information (e.g., an audio program) using electromagnetic signals as claimed, other persons could transmit exactly the same information without infringing the claim -- provided a different medium for transmitting the information is used. Claims 2 through 19 are directed to a medium for conveying information, and are not directed to the information so conveyed.

A patent on an assembly of electromagnetic signals as defined by claims 2 through 19 might be considered as analogous (akin) to a patent on a concrete, tangible medium in which information (e.g., an audio program or television program) can be fixed. However, a patent on an assembly of electromagnetic signals as defined by claims 2 through 19 is not analogous (akin) to a patent on the information itself.

#### Rejection under 35 U.S.C. §103

The Examiner rejected claims 2-19 under 35 U.S.C. §103 as being unpatentable over Hamatsu (U.S. Patent 4,862,479) or Short (U.S. Patent 5,031,173). Examiner Office Action,

paper number 7, page 4. The Examiner asserted that both Hamatsu and Short disclose "a composite spreading code produced from shift registers substantially as claimed." Hamatsu discloses a spread spectrum system that uses Gold spreading codes generated from a convolution coder. These codes are generated by the transition of stages within a buffer or shift register and are implemented using modulo 2 adders. A channel is then divided according to the generated spreading codes (Gold codes).

Short discloses a decoder that may be used in a receiver to identify the spreading code embedded in a bit sequence within a spread spectrum signal array and retrieve information from the corresponding bit sequence. Specifically, Short describes a filter array matched to spreading codes within the spread spectrum system so that a receiver may receive multiple bit streams within the same channel. This decoder includes bit error correction that identifies "interfered" bits within a sequence. This interference is caused by bit overlap of multiple bit streams. These interfered bits are recovered using cross correlation of the spreading codes of the interfering bit streams.

Appellant claims a spread spectrum signal array that is generated by using multiple, distinct subsets of a spreading code sequence. Specifically, all claims require that at least one of these subsets contains more than one spreading

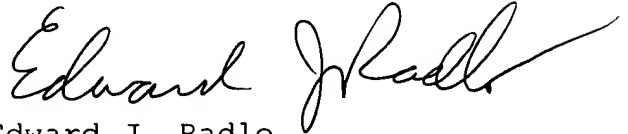
code sequence. The use of multiple subsets provides higher accuracy in determining the particular node to which a spread spectrum signal is assigned. This higher degree of accuracy is a result of optimizing the cross correlation properties of the spreading code sequences assigned to a given node. As a result of the multiple subsets, various identification methods, such as performing a punctured sum of the correlation magnitudes of each of the subsets, may be employed that provide a higher degree of accuracy in signal recognition within the spread spectrum system. As a result, the "near/far" problem with existing spread spectrum systems, including those employing Gold spreading codes, is minimized.

As described above, Hamatsu divides a communications channel by convolving Gold codes, and neither teaches nor suggests the use of spreading code subsets containing multiple sequences. In fact, Hamatsu neither addresses nor attempts to solve the "near/far" problem. The matched filter described in Short provides a cross-correlation of data bits that overlap within multiple bit sequences and a method for correcting these bits at detection. Although this method provides a higher level of accuracy at a receiver in a spread spectrum system, the circuit does not provide greater node identification accuracy as described above; rather, stream accuracy is addressed at a bit-by-bit level. Therefore, the detection methods described in Short

neither teach nor suggest the manner in which the claimed signals are generated. Moreover, the combination of Hamatsu and Short neither teaches nor suggests the manner in which the claimed signals are generated.

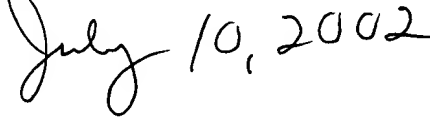
For the above reasons, the Board is asked to reverse the Examiner's rejection of claims 2-19 under 35 U.S.C. §101 and 35 U.S.C. §103, and to allow these claims as presently amended.

Respectfully submitted,



Edward J. Radlo  
Attorney for Appellant  
Registration No. 26,793

date of signature:



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enclosures

9. Appendix -- Claims 2 through 19

2. An assembly of simultaneously transmitted electromagnetic signals, said signals being related to each other in said assembly so as to communicate stored information to a receiver, said signals being generated by modulating selected subsets of a set of stored binary spreading-code sequences corresponding to nodes in a multi-node communication network onto a sinusoidal electromagnetic carrier, at least one subset of said set of binary spreading-code sequences containing more than one of said binary spreading-code sequences, each subset of said set of binary spreading-code sequences embodying a corresponding portion of said information.

3. An assembly of simultaneously transmitted electromagnetic signals, said signals being related to each other in said assembly so as to communicate stored information within a transmitting node to a receiving node in a multi-node communication network, said assembly of signals being produced by a process of:

- a) assigning blocks of bits embodying said stored information to corresponding subsets of a set of stored binary spreading-code sequences corresponding to nodes in said multi-node communication network, at least one of said

subsets of said set of binary spreading-code sequences containing more than one of said binary spreading-code sequences; and

- b) simultaneously transmitting selected subsets of said set of stored binary spreading-code sequences from said transmitting node to said receiving node.

4. An assembly of electromagnetic signals, said signals being related to each other in said assembly so as to communicate stored information within a transmitting node to a particular receiving node of a multi-node communication network, said assembly of signals being produced by a process of:

- a) generating a set of stored binary spreading-code sequences by combining a first group of stored data with a second group of stored data, said set of stored binary spreading-code sequences containing more than one binary spreading-code sequence;
- b) assigning blocks of bits embodying said stored information to corresponding subsets of said set of stored binary spreading-code sequences, each of said subsets of said set of binary spreading-code sequences containing at least one of said stored binary spreading-code sequences; and

- c) transmitting selected subsets of said set of binary spreading-code sequences from said transmitting node to said receiving node.

5. The assembly of signals of claim 2 wherein said set of stored binary spreading-code sequences comprises combined contents of specified stages of a first binary shift register and a second binary shift register.

6. The assembly of signals of claim 2 wherein said set of stored binary spreading-code sequences comprises combined contents of specified stages stored within at least one random access memory module.

7. The assembly of signals of claim 2 wherein each of said selected subsets of said set of stored binary spreading-code sequences comprises two binary spreading-code sequences.

8. The assembly of signals of claim 7 wherein the two binary sequences comprising each of said selected subsets are transmitted simultaneously by modulating a first binary sequence onto a first sinusoidal electromagnetic carrier signal, and by modulating a second binary sequence onto a second sinusoidal electromagnetic carrier signal, said first and second carrier signals having the same frequency but being out of phase with each other.

9. The assembly of signals of claim 2 wherein each of said selected subsets of said set of stored binary spreading-code sequences comprises three binary spreading-code sequences.

10. The assembly of signals of claim 9 wherein the three stored binary sequences comprising each of said selected subsets are transmitted simultaneously by modulating a first binary sequence onto a first sinusoidal electromagnetic carrier signal, by modulating a second binary sequence onto a second sinusoidal electromagnetic carrier signal, and by modulating a third binary sequence onto a third sinusoidal electromagnetic carrier signal, said first, second and third carrier signals having the same frequency but being out of phase with each other.

11. The assembly of signals of claim 2 wherein each of said selected subsets of said set of stored binary spreading-code sequences comprises four binary spreading-code sequences.

12. The assembly of signals of claim 11 wherein the four stored binary sequences comprising each of said selected subsets are transmitted simultaneously by modulating a first binary sequence onto a first sinusoidal electromagnetic carrier signal, by modulating a second binary sequence onto a second sinusoidal electromagnetic carrier signal, by modulating a third binary sequence onto a



third sinusoidal electromagnetic carrier signal, and by modulating a fourth binary sequence onto a fourth sinusoidal electromagnetic carrier signal, said first, second, third, and fourth carrier signals having the same frequency but being out of phase with each other.

13. The assembly of signals of claim 3 wherein said stored binary spreading-code sequences are generated by combining contents of specified stages of a first binary shift register with contents of specified stages of a second binary shift register.

14. The assembly of signals of claim 3 wherein said stored binary spreading-code sequences are generated by combining contents of specified stages within a random access memory module.

15. The assembly of signals of claim 4 wherein all of said blocks of bits embodying said stored information are of equal fixed length.

16. The assembly of signals of claim 4 wherein, when at least one subset of said set of stored binary spreading-code sequences comprises more than one sequence:

- a) each of said subsets of said set of stored binary sequences received at said particular receiving node is correlated with each binary sequence of said set of binary sequences so as to produce a

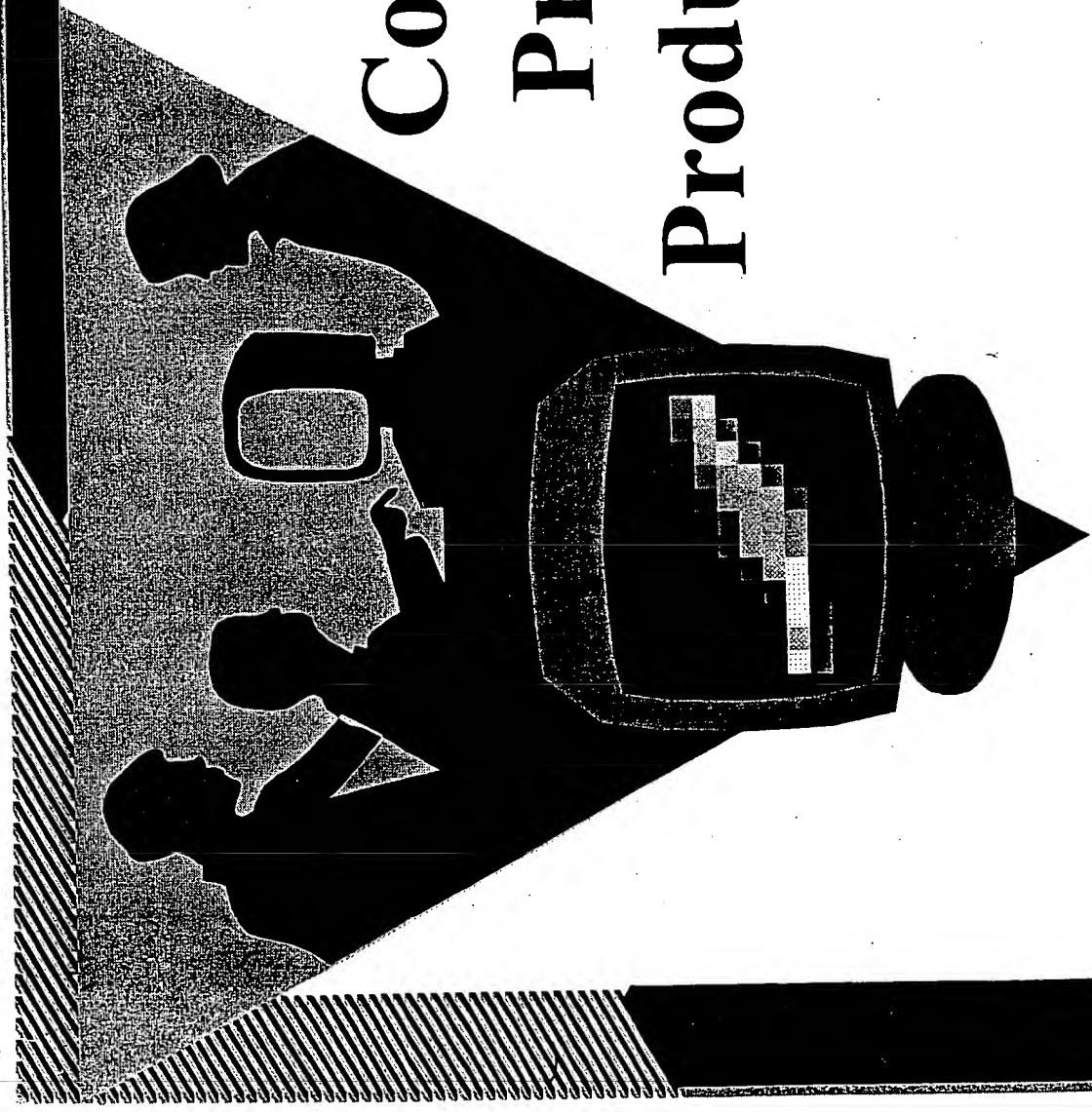
set of correlation outputs, each correlation output corresponding to a specified one of said binary sequences, and

- b) said set of correlation outputs is evaluated to identify a particular one of said subsets of said set of binary sequences as being most likely to have been transmitted from said transmitting node to said particular receiving node.

17. The assembly of signals of claim 16 wherein each of said selected subsets of said set of stored binary spreading-code sequences comprises two binary spreading-code sequences.

18. The assembly of signals of claim 16 wherein each of said selected subsets of said set of stored binary spreading-code sequences comprises three binary spreading-code sequences.

19. The assembly of signals of claim 16 wherein each of said selected subsets of said set of stored binary spreading-code sequences comprises four binary spreading-code sequences.



# Computer Program Product Claims

**Stephen G. Kunin**

D/AC for Patent Policy & Projects

U.S. Patent & Trademark Office



# Topics

- Examination Guidelines for Computer-Related Inventions
- *In re Lowry*
- Signal Claims
- Computer-Readable Medium Issues



# Examination Guidelines for Computer-Related Inventions

A claimed computer-readable medium encoded with a computer program defines structural and functional interrelationships between the computer program and the medium which permits the computer program's functionality to be realized, and is thus statutory.



## *In re Lowry*

- *In re Lowry*, 32 USPQ2d 1031 (Fed. Cir. 1994)
  - Patent Application of Edward S. Lowry
  - Serial no. 07/181,105
  - Title: Data Processing System Having a Data Structure
  - Relates to storage, use, and management of information residing in a computer memory
  - Claim to data structure that increases computer efficiency held statutory



## *In re Lowry (Continued)*

- Distinguishable from printed matter cases
  - Printed matter cases “dealt with claims defining as the invention certain novel arrangements of printed lines or characters, useful and intelligible only to the human mind.” (*In re Bernhart*, 417 F.2d 1395, 1399, 163 USPQ 611, 615 (CCPA 1969))
  - Printed matter cases have no factual relevance where “the invention as defined by the claims *requires* that the information be processed not by the mind but by a machine, the computer”
- Lowry’s data structures
  - According to Lowry, greatly facilitate data management by data processing systems
  - Are processed by a machine
  - Not accessible other than through sophisticated software systems. Printed matter cases have no factual relevance here.

## *In re Lowry (Continued)*



- Lowry's claims define functional characteristics of the memory.
- Contrary to the PTO's assertion, Lowry does not claim merely the information content of a memory.
- Lowry's data structures, while including data resident in a database, depend only functionally on information content.
- While the information content affects the exact sequence of bits stored in accordance with Lowry's data structures, the claims require specific electronic structural elements which impart a physical organization on the information stored in memory.
- Lowry's invention manages information.
- As Lowry notes, the data structures provide increased computing efficiency.





## *In re Lowry (Continued)*

- More than mere abstraction, the data structures are specific electrical or magnetic structural elements in a memory.
- According to Lowry, the data structures provide tangible benefits:
  - Data stored in accordance with the claimed data structures are more easily accessed, stored, and erased
- Lowry further notes that, unlike prior art data structures, Lowry's data structures simultaneously represent complex data accurately and enable powerful nested operations.
- In short, Lowry's data structures are physical entities that provide increased efficiency in computer operation. They are not analogous to printed matter.



# Signal Claims

## • Does PTO grant patents on signal claims?

### • Koo patent

- *U.S. Patent Number:* 5,568,202
- *Title:* System for Echo Cancellation Comprising an Improved Ghost Cancellation Reference Signal
- *Inventor:* David Koo
- *Assignee:* North American Philips Corporation

### • Claim:

- An electronic reference signal in a system for minimizing the effects of ghosts occurring during the transmission and reception of a television signal over a communications path, wherein said reference signal is embodied in a processor readable memory, is non-cyclic, has a substantially flat frequency response within the bandwidth of said communications path and has a plurality of substantially uniform amplitude peaks over a time interval, and wherein a replica of said reference signal is transmitted as part of said television signal and is utilized by a decoder to derive coefficients which are used with at least one filter to remove said ghosts.



## Signal Claims (Continued)

- Prosecution History of Koo Patent
  - Board of Patent Appeals and Interferences affirmed examiner's rejection of two-hump signal claims as being non-statutory under Section 101.
  - Koo appealed to the Federal Circuit
  - Case remanded to PTO to permit Koo to amend claims to incorporate signal in computer-readable memory



## Signal Claims (Continued)

- Signal claims are:
  - Not disembodied software inventions (*In re Warmerdam*, 33 F.3d at 1361, 31 USPQ2d at 1760)
  - No more ephemeral than element 95 patented in 1964
    - Seaborg patent
      - *U.S. Patent Number*: 3,156,523
      - *Title*: Element 95 and Method of Producing Said Element
      - *Inventor*: Glenn T. Seaborg
      - Assignor to the United States of America as represented by the United States Atomic Energy Commission (now Department of Energy (DOE))



## Signal Claims (Continued)

- Note *In re Breslow*, 205 USPQ 221 (CCPA 1980)
  - Patent Application of David S. Breslow
  - Serial no. 646,309
  - Title: Nitrile Imines
  - New compounds claimed, polyfunctional nitrile imines, were one aspect of a broader invention described in Serial no. 3,418,285, relating to new cross-linking agents, to cross-linking unsaturated polymers, and to cross-linked products so produced. Generally any type of unsaturated polymer, containing ethylenic unsaturation wherein there is at least one hydrogen radical attached to at least one of the carbon atoms of the double bond, can be cross-linked with polyfunctional nitrile imines and that the resulting cross-linked polymers are hard, tough rubbers, substantially insoluble in water and hydrocarbon solvents with improved tensile properties useful in various rubber applications.



## Signal Claims (Continued)

— *In re Breslow*, 205 USPQ 221 (CCPA 1980)

— The issue:

- Are the claimed compounds, which the board admitted in fact do exist and can be produced according to the description of appellant's specification, excluded from the category of "composition of matter" in Section 101 because they are transitory, unstable, and non-isolatable in what the board called a "reasonably *stable* form"?

— Decision:

- CCPA held that an intermediate product that exists only as a transitory composition of matter when making a final product was patentable subject matter.



## Signal Claims (Continued)

- *In re Breslow*, 205 USPQ 221 (CCPA 1980)
- Opinion:
  - PTO's objection was that the compounds, being unstable, cannot be isolated. Lays down as a prerequisite to being "statutory subject matter" that "appellant must enable one to obtain the compounds in a reasonably *stable* form."
  - That is to say, unstable compounds are not "compositions of matter" under Section 101.
  - CCPA found that the requirement that compositions of matter be stable is not read into Section 101; many compounds may find their greatest or even their sole utility in the fact that they are not stable. The preferred manner of using them is to produce them *in situ*, whereupon they exhibit their cross-linking activity, their only disclosed utility.



## Signal Claims (Continued)

- Signal claims are:
  - Manmade and tangible in sense that they can be
  - Sensed
  - Measured
  - Put to useful purpose
  - Meet Supreme Court's definition of manufacture
    - “The production of articles for use from raw or prepared materials by giving to these materials new forms, qualities, properties or combinations, whether by hand-labor or by machinery.”





## Signal Claims (Continued)

- Signal claims are:
  - Capable of affecting operation of the computer by adding new functionality
  - To be evaluated using test set forth in *Arrhythmia Research Tech. v. Corazonix Corp.* (958 F.2d at 1057, 22 USPQ2d at 1036), re: significance of activity which computer is caused to perform.
    - “It is of course true that a modern digital computer manipulates data, usually in binary form, by performing mathematical operations, such as addition, subtraction, multiplication, division, or bit shifting, on the data. But this is only *how* the computer does what it does. Of importance is the significance of the data and their manipulation in the real world, i.e., *what* the computer is doing.”



## Signal Claims (Continued)

- Signal claims are:
  - Just as much computer elements as software
  - Much like other computer elements routinely patented



# Computer-Readable Medium Issues

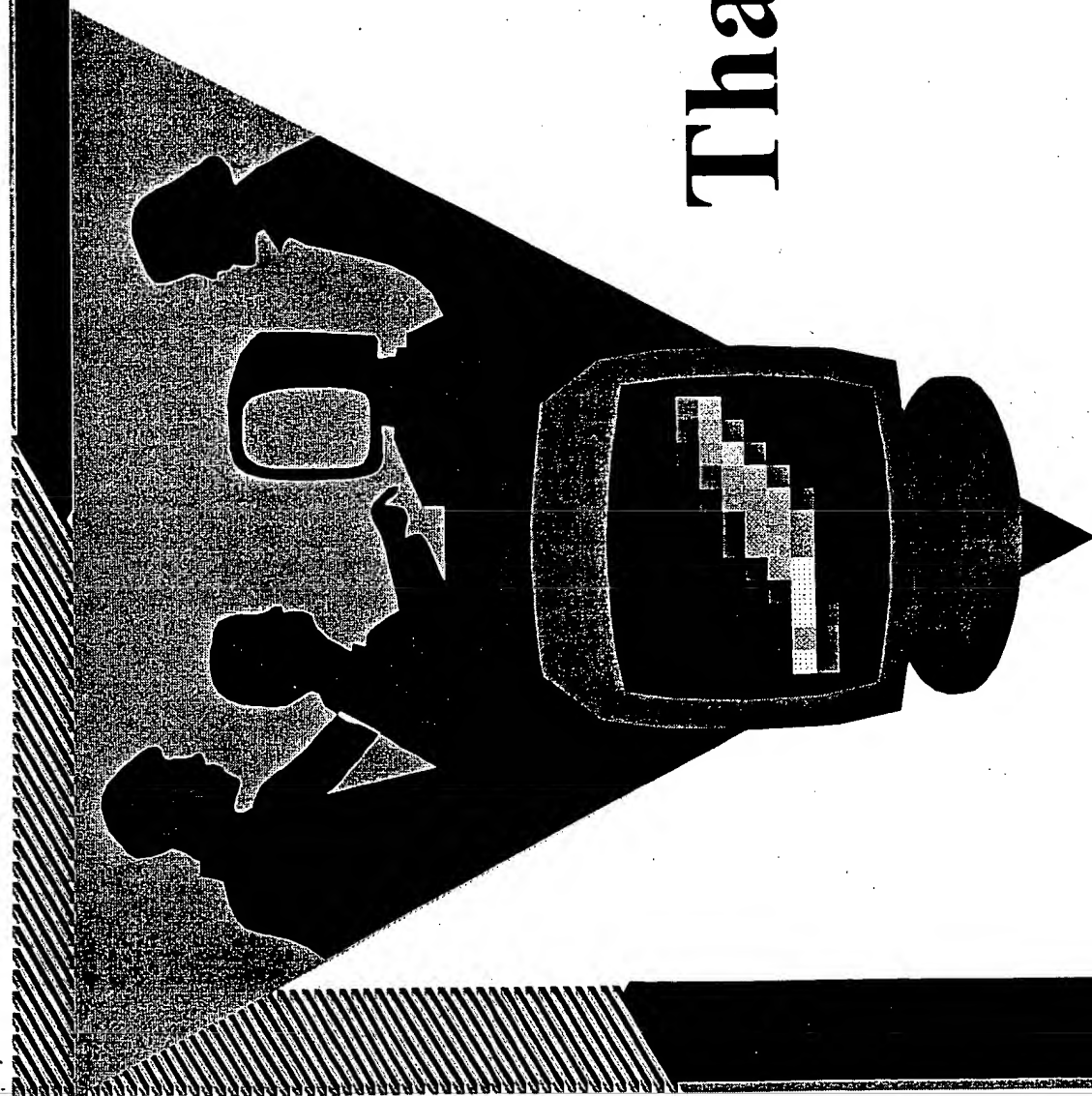
- Shouldn't fixate on what medium is
- Answer question of whether functionality of software can be realized
  - If disembodied, answer is "No"  
(cf. *Warmerdam*)
  - If embodied, answer is "Yes"  
(cf. *Lowry* and *Warmerdam*)



# Computer-Readable Medium Issues (Continued)

- Analyze underlying process that software performs for patentable subject matter. Answer these questions:
  - What is function that software performs?
  - What is significance of function?
  - Is function an abstract idea, law of nature, natural phenomenon?  
(cf. *Abele*, *Walter*, *Schrader*, *Grams*, *Warmerdam*)
  - Does function employ technology?
    - However, cf. *Musgrave*, re mental steps doctrine
    - Claims are usually drawn to computer implemented processes
  - Is function useful?
    - Operable?
    - Has real world value?
    - Provides immediate benefit to public?

# Thank You



*Thurman*

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Ten Basic Ideas of  
Twentieth-Century Physics  
That Everyone Should Know...  
and How They Have Shaped  
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*For Louise*

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blue photons can expel electrons, they do so only at slower speeds. Furthermore, increasing the brightness of the light increases the *number* of photons but not their energy. Bright red light consists of many low-energy photons, none of which is capable of ejecting electrons. With ultraviolet light, even of very low intensity, there may be few photons, but each photon has more than enough energy to expel an electron.

### DUALITY

Einstein was able to explain all the features of the photoelectric effect by assuming that light acted like quantized particles and not like waves. Despite its incomprehensible particle picture of light, Einstein's explanation was so compelling and its influence so far reaching that it won him the 1921 Nobel prize for physics. Light, it seems, has a dual nature—at times acting like waves and at other times like particles.

How was this possible? Waves and particles are contradictory concepts. Electrons, rocks, and planets can be treated like particles; sound and light like waves. Particles are very different from waves. Particles are idealized bodies whose size can be ignored in a given context. The size of the earth is very small on the scale of the Solar System, so it can be treated like a tiny concentrated particle of matter orbiting the sun. The same is true of an electron in an atom. It isn't the absolute size that allows us to treat an object as a particle but its size relative to its environment. An object whose size is negligible in a certain context can be treated like a *point* particle—an idealized concentration of matter at a single point in space. A particle is thus an idealization that has a precisely defined location because it has no extension in space.

By contrast, a wave is diffused over a large region, like water waves on a lake or sound waves in air. It has no well-defined position, nor does it itself consist of matter. The wave is not the medium (material or otherwise) but a move-



ment of the medium. As an ocean wave passes a floating raft, the raft bobs up and down but does not move in the direction of the traveling wave. Only the wave, but not the water, moves toward the shore. A wave is a vibration or disturbance traveling through a medium.

The differences between particles and waves could hardly be more pronounced. Particles are concentrated, localized, and consist of matter. Waves are diffuse, unlocalized, and are not themselves material but vibrations of media. How can light be both a wave and a particle? How can light be both concentrated and diffuse, localized and nonlocalized, material and nonmaterial? And yet Einstein's new analysis of the photoelectric effect demanded a particle picture of light.

Nor is the photoelectric effect unique in treating electromagnetic radiation as particles. High-frequency photons, like x-rays and gamma rays, act just like concentrated little billiard balls when they collide with protons and electrons. Such phenomena that treat light as a particle seem to defy the well-known wave behavior of electromagnetic radiation. Light undergoes diffraction and interference, which are phenomena that uniquely characterize waves. The Maxwell theory, despite some shortcomings, had achieved phenomenal success with a wave picture of light. It seems that light has a dual nature—acting like waves in certain phenomena and like particles in others.

This dual nature of light, and of electromagnetic radiation generally, is a characteristic of all quantum phenomena. Furthermore, as we shall see, duality also characterizes the quantum treatment of electrons, protons, and all subatomic particles. They have a wave nature as well as a particle nature. All matter and energy in the quantum world is dualistic. It combines the conflicting and contradictory properties of both waves and particles.

Yet quantum theory never actually resolves this conflict, nor even acknowledges it as a conflict. We begin to see now why quantum theory is so peculiar and unfamiliar. Quantum theory does not actually interpret nature for us

in the way that classical physics and relativity do. Newton's physics describes a planet orbiting the sun, and we have a clear visual picture of this process, which corresponds precisely to Newton's mathematical description. Einstein's description of planetary motion is conceptually more abstract, but we can still visualize the process by geometrical analogy, and the mathematics of relativity can always be translated into what we actually see in the heavens.

Quantum theory, by contrast, makes no such concessions to visualization. It correctly predicts the photoelectric effect and the interference of light, but it provides no picture of either. In fact, it claims that there are no "deeper" pictures to begin with. It tells us the results of experiments and observations but not why they come out as they do. In quantum theory we treat nature like a black box. If we press buttons and move levers on the box, quantum theory correctly tells us what the meters on the box will read. But it never tells us what is inside the box, why the meters read as they do, or what goes on inside the box between our readings. According to quantum theory, the box has no inside. No wave or particle picture is needed to predict the results of our experiments with light, and there is no deeper picture of light to be discovered. Whatever conflict there is resides not in the predictions but in their interpretation—in the efforts of human beings to visualize what is going on. Quantum theory denies that phenomena have any inner reality. It provides answers only for the results of actual experimental observations, and it tells us nothing about what happens between our observations. Therefore, quantum theory claims that science can provide no pictures of the inner workings of nature.

### ELECTRON WAVES

In the photoelectric effect, we saw that light, which we've always thought of as a wave, acts like a particle or photon. Well, if a wave can act like a particle, then perhaps a particle can also act like a wave. In 1924, Louis de Broglie

considered this possibility. He suggested that an electron—a particle—could act like a wave. De Broglie's conjecture turned out to be correct. (He later received the Nobel prize for it.)

Since 1924, much evidence has accumulated to support de Broglie's hypothesis. A very good example is the phenomenon of electron diffraction. A beam of electrons strikes a crystal inside a cathode-ray tube (essentially a television picture tube). The beam is then diffracted, or dispersed, as the electrons interact with the regularly spaced layers of atoms in the crystal. This diffraction shows up characteristically as a symmetrical circular pattern on the face of the cathode-ray tube. The electron diffraction pattern is almost identical to the pattern a laser light beam produces when it is diffracted by the evenly spaced wires in a mesh screen. The electron pattern is also similar to the pattern produced by water waves striking a row of regularly spaced wooden piles at a wharf. Diffraction is a phenomenon unique to waves, and the fact that electrons can be diffracted is clear evidence of the validity of de Broglie's hypothesis. Quantum theory incorporates this dual nature of electrons as a matter of course, but it is no more comprehensible than the duality of light.

### THE SPECTRA OF ATOMIC LIGHT

While the new quantum hypotheses for the microworld originated in the attempts to understand such phenomena as black-body radiation, the photoelectric effect, and electron diffraction, its sweeping general power was demonstrated in its ingenious explanation of the atom and all atomic spectra.

By the second decade of the twentieth century, our early thinking about the atom had evolved into the planetary model, which views the atom like a miniature solar system. The negatively charged electrons are imagined as orbiting the positively charged nucleus. The positive nucleus electrically attracts the negative electrons, just as the

# Dictionary of Scientific Literacy

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last longer, and two, recycling a higher percentage of our throw-away material. Accelerating biodegradation can be accomplished by adding moisture and other chemicals to make buried wastes decay quicker—from 40 to 50 years to just 5 or 10 years. More than 50 percent of U.S. trash is recyclable and many communities are recognizing the need for this approach. Japan and West Germany have provided examples of what can be done in recycling. Both countries recycle over 60 percent of their waste as compared to 10 percent in the U.S. One example: It has been estimated that if we all recycled our Sunday newspapers, we could save over 500,000 trees every week. See TOXIC WASTE.

**Watson, James D.** The codiscoverer—along with Francis CRICK—of the structure of DNA, and cowinner—again along with Crick, of the Nobel prize in 1962. Prior to the findings of Watson and Crick, nobody knew exactly what a gene was, what it looked like or how it worked. The story of the discovery of the structure of DNA is told in Watson's candid and sometimes abrasive book, *The Double Helix*. Watson is currently (1991) head of the GENOME PROJECT, the 15-year effort to map all the GENES on every human CHROMOSOME. See DNA, and GENETIC ENGINEERING.

**Watt** A unit of power equal to the rate of work represented by a current of one AMPERE under a pressure of one VOLT. Named after James Watt, Scottish engineer and inventor (1736–1819). See OHM'S LAW.

**Wave Theory** When energy is propagated by means of coherent vibrations, such as is the case with radio or SOUND, it is often described as a wave. In QUANTUM PHYSICS, wave theory postulates that PARTICLES of MATTER and ENERGY exhibit many of the characteristics of waves and may best be described in this manner. This wave-particle duality is a basic feature of nature, and whether LIGHT, for instance, needs to be described as a particle or as a wave depends on the nature of the experiment being performed.

**Weak Nuclear Force** The fundamental FORCE of nature that governs the process of radioactive decay. Ac-

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## Examination Guidelines for Computer-Related Inventions

### I. Introduction

These *Examination Guidelines for Computer-Related Inventions*<sup>1</sup> ("Guidelines") are to assist Office personnel in the examination of applications drawn to computer-related inventions.<sup>2</sup> The Guidelines are based on the Office's current understanding of the law and are believed to be fully consistent with binding precedent of the Supreme Court, the Federal Circuit and the Federal Circuit's predecessor courts.

These Guidelines do not constitute substantive rulemaking and hence do not have the force and effect of law. These Guidelines have been designed to assist Office personnel in analyzing claimed subject matter for compliance with substantive law. Rejections will be based upon the substantive law and it is these rejections which are appealable. Consequently, any failure by Office personnel to follow the Guidelines is neither appealable nor petitionable.

The Guidelines alter the procedures Office personnel will follow when examining applications drawn to computer-related inventions and are equally applicable to claimed inventions implemented in either hardware or software. The Guidelines also clarify the Office's position on certain patentability standards related to this field of technology. Office personnel are to rely on these Guidelines in the event of any inconsistent treatment of issues between these Guidelines and any earlier provided guidance from the Office.

The Freeman-Walter-Abele<sup>3</sup> test may additionally be relied upon in analyzing claims directed solely to a process for solving a mathematical algorithm.

Office personnel have had difficulty in properly treating claims directed to methods of doing business. Claims should not be categorized as methods of doing business. Instead, such claims should be treated like any other process claims, pursuant to these Guidelines when relevant.<sup>4</sup>

The appendix includes a flow chart of the process Office personnel will follow in conducting examinations for computer-related inventions.

## **II. Determine What Applicant Has Invented and Is Seeking to Patent**

It is essential that patent applicants obtain a prompt yet complete examination of their applications. Under the principles of compact prosecution, each claim should be reviewed for compliance with every statutory requirement for patentability in the initial review of the application, even if one or more claims are found to be deficient with respect to some statutory requirement. Thus, Office personnel should state all reasons and bases for rejecting claims in the first Office action. Deficiencies should be explained clearly, particularly when they serve as a basis for a rejection. Whenever practicable, Office personnel should indicate how rejections may be overcome and how problems may be resolved. A failure to follow this approach can lead to unnecessary delays in the prosecution of the application.

Prior to focusing on specific statutory requirements, Office personnel must begin examination by determining what, precisely, the applicant has invented and is seeking to patent,<sup>5</sup> and how the claims relate to and define that invention. Consequently, Office personnel will no longer begin examination by determining if a claim recites a "mathematical algorithm." Rather, they will review the complete specification, including the detailed description of the invention, any specific embodiments that have been disclosed, the claims and any specific utilities that have been asserted for the invention.

### **A. Identify and Understand Any Practical Application Asserted for the Invention**

The subject matter sought to be patented must be a "useful" process, machine, manufacture or composition of matter, i.e., it must have a practical application. The purpose of this requirement is to limit patent protection to inventions that possess a certain level of "real world" value, as opposed to subject matter that represents nothing more than an idea or concept, or is simply a starting point for future investigation

or research.<sup>6</sup> Accordingly, a complete disclosure should contain some indication of the practical application for the claimed invention, i.e., why the applicant believes the claimed invention is useful.

The utility of an invention must be within the "technological" arts.<sup>7</sup> A computer-related invention is within the technological arts. A practical application of a computer-related invention is statutory subject matter. This requirement can be discerned from the variously phrased prohibitions against the patenting of abstract ideas, laws of nature or natural phenomena. An invention that has a practical application in the technological arts satisfies the utility requirement.<sup>8</sup>

The applicant is in the best position to explain why an invention is believed useful. Office personnel should therefore focus their efforts on pointing out statements made in the specification that identify all practical applications for the invention. Office personnel should rely on such statements throughout the examination when assessing the invention for compliance with all statutory criteria. An applicant may assert more than one practical application, but only one is necessary to satisfy the utility requirement. Office personnel should review the entire disclosure to determine the features necessary to accomplish at least one asserted practical application.

**B. Review the Detailed Disclosure and Specific Embodiments of the Invention to Determine What the Applicant Has Invented**

The written description will provide the clearest explanation of the applicant's invention, by exemplifying the invention, explaining how it relates to the prior art and explaining the relative significance of various features of the invention. Accordingly, Office personnel should begin their evaluation of a computer-related invention as follows:

- determine what the programmed computer does when it performs the processes dictated by the software (i.e., the functionality of the programmed computer);<sup>9</sup>
- determine how the computer is to be configured to provide that functionality (i.e., what elements constitute the

programmed computer and how those elements are configured and interrelated to provide the specified functionality); and

- if applicable, determine the *relationship* of the programmed computer to other subject matter outside the computer that constitutes the invention (e.g., machines, devices, materials, or process steps other than those that are part of or performed by the programmed computer).<sup>10</sup>

Patent applicants can assist the Office by preparing applications that clearly set forth these aspects of a computer-related invention.

### C. Review the Claims

The claims define the property rights provided by a patent, and thus require careful scrutiny. The goal of claim analysis is to identify the boundaries of the protection sought by the applicant and to understand how the claims relate to and define what the applicant has indicated is the invention. Office personnel must thoroughly analyze the language of a claim *before* determining if the claim complies with each statutory requirement for patentability.

Office personnel should begin claim analysis by identifying and evaluating each claim limitation. For processes, the claim limitations will define steps or acts to be performed.

For products<sup>11</sup>, the claim limitations will define discrete physical structures. The discrete physical structures may be comprised of hardware or a combination of hardware and software.

Office personnel are to correlate each claim limitation to all portions of the disclosure that describe the claim limitation. This is to be done in all cases, i.e., whether or not the claimed invention is defined using means or step plus function language. The correlation step will ensure that Office personnel correctly interpret each claim limitation.

The subject matter of a properly construed claim is defined by the terms that limit its scope. It is this subject matter that must be examined. As a general matter, the grammar

and intended meaning of terms used in a claim will dictate whether the language limits the claim scope. Language that suggests or makes optional but does not require steps to be performed or does not limit a claim to a particular structure does not limit the scope of a claim or claim limitation.<sup>12</sup>

Office personnel must rely on the applicant's disclosure to properly determine the meaning of terms used in the claims.<sup>13</sup> An applicant is entitled to be his or her own lexicographer, and in many instances will provide an explicit definition for certain terms used in the claims. Where an explicit definition is provided by the applicant for a term, that definition will control interpretation of the term as it is used in the claim. Office personnel should determine if the original disclosure provides a definition consistent with any assertions made by applicant.<sup>14</sup> If an applicant does not define a term in the specification, that term will be given its "common meaning."<sup>15</sup>

If the applicant asserts that a term has a meaning that conflicts with the term's art-accepted meaning, Office personnel should encourage the applicant to amend the claim to better reflect what applicant intends to claim as the invention. If the application becomes a patent, it becomes prior art against subsequent applications. Therefore, it is important for later search purposes to have the patentee employ commonly accepted terminology, particularly for searching text-searchable databases.

Office personnel must always remember to use the perspective of one of ordinary skill in the art. Claims and disclosures are not to be evaluated in a vacuum. If elements of an invention are well known in the art, the applicant does not have to provide a disclosure that describes those elements. In such a case the elements will be construed as encompassing any and every art-recognized hardware or combination of hardware and software technique for implementing the defined requisite functionalities.

Office personnel are to give claims their broadest reasonable interpretation in light of the supporting disclosure.<sup>16</sup> Where means plus function language is used to define the characteristics of a machine or manufacture invention,

claim limitations must be interpreted to read on only the structures or materials disclosed in the specification and "equivalents thereof."<sup>17</sup> Disclosure may be express, implicit or inherent. Thus, at the outset, Office personnel must attempt to correlate claimed means to elements set forth in the written description. The written description includes the specification and the drawings. Office personnel are to give the claimed means plus function limitations their broadest reasonable interpretation consistent with all corresponding structures or materials described in the specification and their equivalents. Further guidance in interpreting the scope of equivalents is provided in the *Examination Guidelines For Claims Reciting A Means or Step Plus Function Limitation In Accordance With 35 U.S.C. 112, 6th Paragraph ("Means Plus Function Guidelines")*.<sup>18</sup>

While it is appropriate to use the specification to determine what applicant intends a term to mean, a positive limitation from the specification cannot be read into a claim that does not impose that limitation. A broad interpretation of a claim by Office personnel will reduce the possibility that the claim, when issued, will be interpreted more broadly than is justified or intended. An applicant can always amend a claim during prosecution to better reflect the intended scope of the claim.

Finally, when evaluating the scope of a claim, every limitation in the claim must be considered.<sup>19</sup> Office personnel may not dissect a claimed invention into discrete elements and then evaluate the elements in isolation. Instead, the claim as a whole must be considered.

### **III. Conduct a Thorough Search of the Prior Art**

Prior to classifying the claimed invention under § 101, Office personnel are expected to conduct a thorough search of the prior art. Generally, a thorough search involves reviewing both U.S. and foreign patents and non-patent literature. In many cases, the result of such a search will contribute to Office personnel's understanding of the invention. Both claimed and unclaimed aspects of the invention described in the specification should be searched if there is a reasonable expectation that the unclaimed aspects may be later claimed. A search must take into



account any structure or material described in the specification and its equivalents which correspond to the claimed means plus function limitation, in accordance with 35 U.S.C. § 112, sixth paragraph and the Means Plus Function Guidelines.<sup>20</sup>

**IV. Determine Whether the Claimed Invention Complies with 35 U.S.C. § 101**

**A. Consider the Breadth of 35 U.S.C. § 101 Under Controlling Law**

As the Supreme Court has held, Congress chose the expansive language of § 101 so as to include "anything under the sun that is made by man."<sup>21</sup> Accordingly, § 101 of title 35, United States Code, provides:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.<sup>22</sup>

As cast, § 101 defines four categories of inventions that Congress deemed to be the appropriate subject matter of a patent; namely, processes, machines, manufactures and compositions of matter. The latter three categories define "things" while the first category defines "actions" (i.e., inventions that consist of a series of steps or acts to be performed).<sup>23</sup>

Federal courts have held that § 101 does have certain limits. First, the phrase "anything under the sun that is made by man" is limited by the text of § 101, meaning that one may only patent something that is a machine, manufacture, composition of matter or a process.<sup>24</sup> Second, § 101 requires that the subject matter sought to be patented be a "useful" invention. Accordingly, a complete definition of the scope of § 101, reflecting Congressional intent, is that any new and useful process, machine, manufacture or composition of matter under the sun that is made by man is the proper subject matter of a patent.

Subject matter not within one of the four statutory invention categories or which is not "useful" in a patent sense is, accordingly, not eligible to be patented.

The subject matter courts have found to be outside the four statutory categories of invention is limited to abstract ideas, laws of nature and natural phenomena. While this is easily stated, determining whether an applicant is seeking to patent an abstract idea, a law of nature or a natural phenomenon has proven to be challenging. These three exclusions recognize that subject matter that is not a practical application or use of an idea, a law of nature or a natural phenomenon is not patentable.<sup>25</sup>

Courts have expressed a concern over "preemption" of ideas, laws of nature or natural phenomena.<sup>26</sup> The concern over preemption serves to bolster and justify the prohibition against the patenting of such subject matter. In fact, such concerns are only relevant to claiming a scientific truth or principle. Thus, a claim to an "abstract idea" is non-statutory because it does not represent a practical application of the idea, not because it would preempt the idea.

**B. Classify the Claimed Invention as to Its Proper Statutory Category**

To properly determine whether a claimed invention complies with the statutory invention requirements of § 101, Office personnel should classify each claim into one or more statutory or non-statutory categories. If the claim falls into a non-statutory category, that should not preclude complete examination of the application for satisfaction of all other conditions of patentability. This classification is only an initial finding at this point in the examination process that will be again assessed after the examination for compliance with §§ 102, 103 and 112 is completed and before issuance of any Office action on the merits.

If the invention as set forth in the written description is statutory, but the claims define subject matter that is not, the deficiency can be corrected by an appropriate amendment of the claims. In such a case, Office personnel should reject the claims drawn to non-statutory subject matter under § 101, but identify the features of the invention that would render the claimed subject matter statutory if recited in the claim.

## 1. Non-Statutory Subject Matter

Claims to computer-related inventions that are clearly non-statutory fall into the same general categories as non-statutory claims in other arts, namely natural phenomena such as magnetism, and abstract ideas or laws of nature which constitute "descriptive material." Descriptive material can be characterized as either "functional descriptive material" or "non-functional descriptive material." In this context, "functional descriptive material" consists of data structures<sup>27</sup> and computer programs which impart functionality when encoded on a computer-readable medium. "Non-functional descriptive material" includes but is not limited to music, literary works and a compilation or mere arrangement of data.

Both types of "descriptive material" are non-statutory when claimed as descriptive material *per se*. When functional descriptive material is recorded on some computer-readable medium it becomes structurally and functionally interrelated to the medium and will be statutory in most cases.<sup>28</sup> When non-functional descriptive material is recorded on some computer-readable medium, it is not structurally and functionally interrelated to the medium but is merely carried by the medium. Merely claiming non-functional descriptive material stored in a computer-readable medium does not make it statutory. Such a result would exalt form over substance.<sup>29</sup> Thus, non-statutory music does not become statutory by merely recording it on a compact disk. Protection for this type of work is provided under the copyright law.

Claims to processes that do nothing more than solve mathematical problems or manipulate abstract ideas or concepts are more complex to analyze and are addressed below. See sections IV.B.2(d) and IV.B.2(e).

### (a) Functional Descriptive Material: "Data Structures" Representing Descriptive Material *Per Se* or Computer Programs Representing Computer Listings *Per Se*

Data structures not claimed as embodied in computer-readable media are descriptive material *per se* and are not statutory because they are neither physical "things" nor

statutory processes.<sup>30</sup> Such claimed data structures do not define any structural and functional interrelationships between the data structure and other claimed aspects of the invention which permit the data structure's functionality to be realized. In contrast, a claimed computer-readable medium encoded with a data structure defines structural and functional interrelationships between the data structure and the medium which permit the data structure's functionality to be realized, and is thus statutory.

Similarly, computer programs claimed as computer listings *per se*, i.e., the descriptions or expressions of the programs, are not physical "things," nor are they statutory processes, as they are not "acts" being performed. Such claimed computer programs do not define any structural and functional interrelationships between the computer program and other claimed aspects of the invention which permit the computer program's functionality to be realized. In contrast, a claimed computer-readable medium encoded with a computer program defines structural and functional interrelationships between the computer program and the medium which permit the computer program's functionality to be realized, and is thus statutory. Accordingly, it is important to distinguish claims that define descriptive material *per se* from claims that define statutory inventions.

Computer programs are often recited as part of a claim. Office personnel should determine whether the computer program is being claimed as part of an otherwise statutory manufacture or machine. In such a case, the claim remains statutory irrespective of the fact that a computer program is included in the claim. The same result occurs when a computer program is used in a computerized process where the computer executes the instructions set forth in the computer program. Only when the claimed invention taken as a whole is directed to a mere program listing, i.e., to only its description or expression, is it descriptive material *per se* and hence non-statutory.

Since a computer program is merely a set of instructions capable of being executed by a computer, the computer program itself is not a process and Office personnel should treat a claim for a computer program, without the computer-readable medium

needed to realize the computer program's functionality, as non-statutory functional descriptive material. When a computer program is claimed in a process where the computer is executing the computer program's instructions, Office personnel should treat the claim as a process claim. See Sections IV.B.2(b)-(e).

When a computer program is recited in conjunction with a physical structure, such as a computer memory, Office personnel should treat the claim as a product claim. See Section IV.B.2(a).

**(b) Non-Functional Descriptive Material**

Descriptive material that cannot exhibit any functional interrelationship with the way in which computing processes are performed does not constitute a statutory process, machine, manufacture or composition of matter and should be rejected under § 101. Thus, Office personnel should consider the claimed invention as a whole to determine whether the necessary functional interrelationship is provided.

Where certain types of descriptive material, such as music, literature, art, photographs and mere arrangements or compilations of facts or data,<sup>31</sup> are merely stored so as to be read or outputted by a computer without creating any functional interrelationship, either as part of the stored data or as part of the computing processes performed by the computer, then such descriptive material alone does not impart functionality either to the data as so structured, or to the computer. Such "descriptive material" is not a process, machine, manufacture or composition of matter.

The policy that precludes the patenting of non-functional descriptive material would be easily frustrated if the same descriptive material could be patented when claimed as an article of manufacture.<sup>32</sup> For example, music is commonly sold to consumers in the format of a compact disc. In such cases, the known compact disc acts as nothing more than a carrier for non-functional descriptive material. The purely non-functional descriptive material cannot alone provide the practical application for the manufacture.

Office personnel should be prudent in applying the foregoing guidance. Non-functional descriptive material may be claimed in combination with other functional descriptive material on a computer-readable medium to provide the necessary functional and structural interrelationship to satisfy the requirements of § 101. The presence of the claimed non-functional descriptive material is not necessarily determinative of non-statutory subject matter. For example, a computer that recognizes a particular grouping of musical notes read from memory and upon recognizing that particular sequence, causes another defined series of notes to be played, defines a functional interrelationship among that data and the computing processes performed when utilizing that data, and as such is statutory because it implements a statutory process.

**(c) Natural Phenomena Such as Electricity and Magnetism**

Claims that recite nothing but the physical characteristics of a form of energy, such as a frequency, voltage, or the strength of a magnetic field, define energy or magnetism, *per se*, and as such are non-statutory natural phenomena.<sup>33</sup> However, a claim directed to a practical application of a natural phenomenon such as energy or magnetism is statutory.<sup>34</sup>

**2. Statutory Subject Matter**

**(a) Statutory Product Claims<sup>35</sup>**

If a claim defines a useful machine or manufacture by identifying the physical structure of the machine or manufacture in terms of its hardware or hardware and software combination, it defines a statutory product.<sup>36</sup>

A machine or manufacture claim may be one of two types: (1) a claim that encompasses any and every machine for performing the underlying process or any and every manufacture that can cause a computer to perform the underlying process, or (2) a claim that defines a specific machine or manufacture. When a claim is of the first type, Office personnel are to evaluate the underlying process the computer will perform in order to determine the patentability of the product.

(i) Claims that Encompass Any Machine or Manufacture  
Embodiment of a Process

Office personnel must treat each claim as a whole. The mere fact that a hardware element is recited in a claim does not necessarily limit the claim to a specific machine or manufacture.<sup>37</sup> If a product claim encompasses any and every computer implementation of a process, when read in light of the specification, it should be examined on the basis of the underlying process. Such a claim can be recognized as it will:

- define the physical characteristics of a computer or computer component exclusively as functions or steps to be performed on or by a computer, and
- encompass any and every product in the stated class (e.g., computer, computer-readable memory) configured in any manner to perform that process.

Office personnel are reminded that finding a product claim to encompass any and every product embodiment of a process invention simply means that the Office will presume that the product claim encompasses any and every hardware or hardware platform and associated software implementation that performs the specified set of claimed functions. Because this is interpretive and nothing more, it does not provide any information as to the patentability of the applicant's underlying process or the product claim.

When Office personnel have reviewed the claim as a whole and found that it is not limited to a specific machine or manufacture, they shall identify how each claim limitation has been treated and set forth their reasons in support of their conclusion that the claim encompasses any and every machine or manufacture embodiment of a process. This will shift the burden to applicant to demonstrate why the claimed invention should be limited to a specific machine or manufacture.

If a claim is found to encompass any and every product embodiment of the underlying process, and if the underlying process is statutory, the product claim should be classified as a

statutory product. By the same token, if the underlying process invention is found to be non-statutory, Office personnel should classify the "product" claim as a "non-statutory product." If the product claim is classified as being a non-statutory product on the basis of the underlying process, Office personnel should emphasize that they have considered all claim limitations and are basing their finding on the analysis of the underlying process.

**(ii) Product Claims--Claims Directed to Specific Machines and Manufactures**

If a product claim does not encompass any and every computer-implementation of a process, then it must be treated as a specific machine or manufacture. Claims that define a computer-related invention as a specific machine or specific article of manufacture must define the physical structure of the machine or manufacture in terms of its hardware or hardware and "specific software."<sup>38</sup> The applicant may define the physical structure of a programmed computer or its hardware or software components in any manner that can be clearly understood by a person skilled in the relevant art. Generally a claim drawn to a particular programmed computer should identify the elements of the computer and indicate how those elements are configured in either hardware or a combination of hardware and specific software.

To adequately define a specific computer memory, the claim must identify a general or specific memory and the specific software which provides the functionality stored in the memory.

A claim limited to a specific machine or manufacture, which has a practical application in the technological arts, is statutory. In most cases, a claim to a specific machine or manufacture will have a practical application in the technological arts.

**(iii) Hypothetical Machine Claims Which Illustrate Claims of the Types Described in Sections IV.B.2(a)(i) and (ii)**

Two applicants present a claim to the following process:



A process for determining and displaying the structure of a chemical compound comprising:

- (a) solving the wavefunction parameters for the compound to determine the structure of a compound; and
- (b) displaying the structure of the compound determined in step (a).

Each applicant also presents a claim to the following apparatus:

A computer system for determining the three dimensional structure of a chemical compound comprising:

- (a) means for determining the three dimensional structure of a compound; and
- (b) means for creating and displaying an image representing a three-dimensional perspective of the compound.

In addition, each applicant provides the noted disclosures to support the claims:

Applicant A

Applicant B

Disclosure	<p>The disclosure describes specific software, i.e., specific program code segments, that are to be employed to configure a general purpose microprocessor to create specific logic circuits. These circuits are indicated to be the "means" corresponding to the claimed means limitations.</p>	<p>The disclosure states that it would be a matter of routine skill to select an appropriate conventional computer system and implement the claimed process on that computer system. The disclosure does not have specific disclosure that corresponds to the two "means" limitations recited in the claim (i.e., no specific software or logic circuit). The disclosure does have an explanation of how to solve the wavefunction equations of a chemical compound, and indicates that the solutions of those wavefunction equations can be employed to determine the physical structure of the corresponding compound.</p>
Result	<p>Claim defines specific computer, patentability stands independently from process claim.</p>	<p>Claim encompasses any computer embodiment of process claim; patentability stands or falls with process claim.</p>
Explanation	<p>Disclosure identifies the specific machine capable of performing the indicated functions.</p>	<p>Disclosure does not provide any information to distinguish the "implementation" of the process on a computer from the factors that will govern the patentability determination of the process per se. As such, the patentability of this apparatus claim will stand or fall with that of the process claim.</p>

**(b) Statutory Process Claims**

A claim that requires one or more acts to be performed defines a process. However, not all processes are statutory under § 101. To be statutory, a claimed computer-related process must either: (1) result in a physical transformation outside the computer for which a practical application in the technological arts is either disclosed in the specification or would have been known to a skilled artisan (discussed in (i) below),<sup>39</sup> or (2) be limited by the language in the claim to a practical application within the technological arts (discussed in (ii) below).<sup>40</sup> The claimed practical application must be a further limitation upon the claimed subject matter if the process is confined to the internal operations of the computer. If a physical transformation occurs outside the computer, it is not necessary to claim the practical application. A disclosure that permits a skilled artisan to practice the claimed invention, i.e., to put it to a practical use, is sufficient. On the other hand, it is necessary to claim the practical application if there is no physical transformation or if the process merely manipulates concepts or converts one set of numbers into another.

A claimed process is clearly statutory if it results in a physical transformation outside the computer, i.e., falls into one or both of the following specific categories ("safe harbors").

**(i) Safe Harbors**

**- Independent Physical Acts (Post-Computer Process Activity)**

A process is statutory if it requires physical acts to be performed outside the computer independent of and following the steps to be performed by a programmed computer, where those acts involve the manipulation of tangible physical objects and result in the object having a different physical attribute or structure.<sup>41</sup> Thus, if a process claim includes one or more post-computer process steps that result in a physical transformation outside the computer (beyond merely conveying the direct result of the computer operation, see Section IV.B.2(d)(iii)), the claim is clearly statutory.

Examples of this type of statutory process include the following:

- A method of curing rubber in a mold which relies upon updating process parameters, using a computer processor to determine a time period for curing the rubber, using the computer processor to determine when the time period has been reached in the curing process and then opening the mold at that stage.
- A method of controlling a mechanical robot which relies upon storing data in a computer that represents various types of mechanical movements of the robot, using a computer processor to calculate positioning of the robot in relation to given tasks to be performed by the robot, and controlling the robot's movement and position based on the calculated position.
- **Manipulation of Data Representing Physical Objects or Activities (Pre-Computer Process Activity)**

Another statutory process is one that requires the measurements of physical objects or activities to be transformed outside of the computer into computer data,<sup>42</sup> where the data comprises signals corresponding to physical objects or activities external to the computer system, and where the process causes a physical transformation of the signals which are intangible representations of the physical objects or activities.<sup>43</sup>

Examples of this type of claimed statutory process include the following:

- A method of using a computer processor to analyze electrical signals and data representative of human cardiac activity by converting the signals to time segments, applying the time segments in reverse order to a high pass filter means, using the computer processor to determine the amplitude of the high pass filter's output, and using the computer processor to compare the value to a predetermined value. In this example the data is an intangible representation of physical activity, i.e., human cardiac activity. The transformation occurs when heart activity is measured and an electrical signal is produced. This process has real world value in predicting vulnerability to ventricular tachycardia immediately after a heart attack.

- A method of using a computer processor to receive data representing Computerized Axial Tomography ("CAT") scan images of a patient, performing a calculation to determine the difference between a local value at a data point and an average value of the data in a region surrounding the point, and displaying the difference as a gray scale for each point in the image, and displaying the resulting image. In this example the data is an intangible representation of a physical object, i.e., portions of the anatomy of a patient. The transformation occurs when the condition of the human body is measured with X-rays and the X-rays are converted into electrical digital signals that represent the condition of the human body. The real world value of the invention lies in creating a new CAT scan image of body tissue without the presence of bones.

- A method of using a computer processor to conduct seismic exploration, by imparting spherical seismic energy waves into the earth from a seismic source, generating a plurality of reflected signals in response to the seismic energy waves at a set of receiver positions in an array, and summing the reflection signals to produce a signal simulating the reflection response of the earth to the seismic energy. In this example, the electrical signals processed by the computer represent reflected seismic energy. The transformation occurs by converting the spherical seismic energy waves into electrical signals which provide a geophysical representation of formations below the earth's surface. Geophysical exploration of formations below the surface of the earth has real world value.

If a claim does not clearly fall into one or both of the safe harbors, the claim may still be statutory if it is limited by the language in the claim to a practical application in the technological arts.

**(ii) Computer-Related Processes Limited to a Practical Application in the Technological Arts**

There is always some form of physical transformation within a computer because a computer acts on signals and transforms them during its operation and changes the state of its components during the execution of a process. Even though such a

physical transformation occurs within a computer, such activity is not determinative of whether the process is statutory because such transformation alone does not distinguish a statutory computer process from a non-statutory computer process. What is determinative is not how the computer performs the process, but what the computer does to achieve a practical application.<sup>44</sup>

A process that merely manipulates an abstract idea or performs a purely mathematical algorithm is non-statutory despite the fact that it might inherently have some usefulness.<sup>45</sup> For such subject matter to be statutory, the claimed process must be limited to a practical application of the abstract idea or mathematical algorithm in the technological arts.<sup>46</sup> For example, a computer process that simply calculates a mathematical algorithm that models noise is non-statutory. However, a claimed process for digitally filtering noise employing the mathematical algorithm is statutory.

Examples of this type of claimed statutory process include the following:

- A computerized method of optimally controlling transfer, storage and retrieval of data between cache and hard disk storage devices such that the most frequently used data is readily available.
- A method of controlling parallel processors to accomplish multi-tasking of several computing tasks to maximize computing efficiency.<sup>47</sup>
- A method of making a word processor by storing an executable word processing application program in a general purpose digital computer's memory, and executing the stored program to impart word processing functionality to the general purpose digital computer by changing the state of the computer's arithmetic logic unit when program instructions of the word processing program are executed.
- A digital filtering process for removing noise from a digital signal comprising the steps of calculating a mathematical algorithm to produce a correction signal and subtracting the correction signal from the digital signal to remove the noise.

(c) Non-Statutory Process Claims

If the "acts" of a claimed process manipulate only numbers, abstract concepts or ideas, or signals representing any of the foregoing, the acts are not being applied to appropriate subject matter. Thus, a process consisting solely of mathematical operations, i.e., converting one set of numbers into another set of numbers, does not manipulate appropriate subject matter and thus cannot constitute a statutory process.

In practical terms, claims define non-statutory processes if they:

- consist solely of mathematical operations without some claimed practical application (i.e., executing a "mathematical algorithm"); or
- simply manipulate abstract ideas, e.g., a bid<sup>48</sup> or a bubble hierarchy,<sup>49</sup> without some claimed practical application.

A claimed process that consists solely of mathematical operations is non-statutory whether or not it is performed on a computer. Courts have recognized a distinction between types of mathematical algorithms, namely, some define a "law of nature" in mathematical terms and others merely describe an "abstract idea."<sup>50</sup>

Certain mathematical algorithms have been held to be non-statutory because they represent a mathematical definition of a law of nature or a natural phenomenon. For example, a mathematical algorithm representing the formula  $E=mc^2$  is a "law of nature"--it defines a "fundamental scientific truth" (i.e., the relationship between energy and mass). To comprehend how the law of nature relates to any object, one invariably has to perform certain steps (e.g., multiplying a number representing the mass of an object by the square of a number representing the speed of light). In such a case, a claimed process which consists solely of the steps that one must follow to solve the mathematical representation of  $E=mc^2$  is indistinguishable from the law of nature and would "preempt" the law of nature. A patent cannot be granted on such a process.

Other mathematical algorithms have been held to be non-statutory because they merely describe an abstract idea. An "abstract idea" may simply be any sequence of mathematical operations that are combined to solve a mathematical problem. The concern addressed by holding such subject matter non-statutory is that the mathematical operations merely describe an idea and do not define a process that represents a practical application of the idea.

Accordingly, when a claim reciting a mathematical algorithm is found to define non-statutory subject matter the basis of the § 101 rejection must be that, when taken as a whole, the claim recites a law of nature, a natural phenomenon, or an abstract idea.

**(d) Certain Claim Language Related to Mathematical Operation Steps of a Process**

**(i) Intended Use or Field of Use Statements**

Claim language that simply specifies an intended use or field of use for the invention generally will not limit the scope of a claim, particularly when only presented in the claim preamble. Thus, Office personnel should be careful to properly interpret such language.<sup>51</sup> When such language is treated as non-limiting, Office personnel should expressly identify in the Office action the claim language that constitutes the intended use or field of use statements and provide the basis for their findings. This will shift the burden to applicant to demonstrate why the language is to be treated as a claim limitation.

**(ii) Necessary Antecedent Step to Performance of a Mathematical Operation or Independent Limitation on a Claimed Process**

In some situations, certain acts of "collecting" or "selecting" data for use in a process consisting of one or more mathematical operations will not further limit a claim beyond the specified mathematical operation step(s). Such acts merely



determine values for the variables used in the mathematical formulae used in making the calculations.<sup>52</sup> In other words, the acts are dictated by nothing other than the performance of a mathematical operation.<sup>53</sup>

If a claim requires acts to be performed to create data that will then be used in a process representing a *practical application* of one or more mathematical operations, those acts *must* be treated as further limiting the claim beyond the mathematical operation(s) *per se*. Such acts are data gathering steps not dictated by the algorithm but by other limitations which require certain antecedent steps and as such constitute an independent limitation on the claim.

Examples of acts that independently limit a claimed process involving mathematical operations include:

- a method of conducting seismic exploration which requires generating and manipulating signals from seismic energy waves before "summing" the values represented by the signals;<sup>54</sup> and
- a method of displaying X-ray attenuation data as a signed gray scale signal in a "field" using a particular algorithm, where the antecedent steps require generating the data using a particular machine (e.g., a computer tomography scanner).<sup>55</sup>

Examples of steps that do not independently limit one or more mathematical operation steps include:

- "perturbing" the values of a set of process inputs, where the subject matter "perturbed" was a number and the act of "perturbing" consists of substituting the numerical values of variables;<sup>56</sup> and
- selecting a set of arbitrary measurement point values.<sup>57</sup>

Such steps do not impose independent limitations on the scope of the claim beyond those required by the mathematical operation limitation.

(iii) Post-Mathematical Operation Step Using Solution or Merely Conveying Result of Operation

In some instances, certain kinds of post-solution "acts" will not further limit a process claim beyond the performance of the preceding mathematical operation step even if the acts are recited in the body of a claim. If, however, the claimed acts represent some "significant use" of the solution, those acts will invariably impose an independent limitation on the claim. A "significant use" is any activity which is more than merely outputting the direct result of the mathematical operation. Office personnel are reminded to rely on the applicant's characterization of the significance of the acts being assessed to resolve questions related to their relationship to the mathematical operations recited in the claim and the invention as a whole.<sup>58</sup> Thus, if a claim requires that the direct result of a mathematical operation be evaluated and transformed into something else, Office personnel cannot treat the subsequent steps as being indistinguishable from the performance of the mathematical operation and thus not further limiting on the claim. For example, acts that require the conversion of a series of numbers representing values of a wavefunction equation for a chemical compound into values representing an image that conveys information about the three-dimensional structure of the compound and the displaying of the three-dimensional structure cannot be treated as being part of the mathematical operations.

Office personnel should be especially careful when reviewing claim language that requires the performance of "post-solution" steps to ensure that claim limitations are not ignored.

Examples of steps found not to independently limit a process involving one or more mathematical operation steps include:

- step of "updating alarm limits" found to constitute changing the number value of a variable to represent the result of the calculation;<sup>59</sup>
- final step of magnetically recording the result of a calculation;<sup>60</sup>

- final step of "equating" the process outputs to the values of the last set of process inputs found to constitute storing the result of calculations;<sup>61</sup>
- final step of displaying result of a calculation "as a shade of gray rather than as simply a number" found to not constitute distinct step where the data were numerical values that did not represent anything;<sup>62</sup> and
- step of "transmitting electrical signals representing" the result of calculations.<sup>63</sup>

**(e) Manipulation of Abstract Ideas Without a Claimed Practical Application**

A process that consists solely of the manipulation of an abstract idea without any limitation to a practical application is non-statutory.<sup>64</sup> Office personnel have the burden to establish a *prima facie* case that the claimed invention taken as a whole is directed to the manipulation of abstract ideas without a practical application.

In order to determine whether the claim is limited to a practical application of an abstract idea, Office personnel must analyze the claim as a whole, in light of the specification, to understand what subject matter is being manipulated and how it is being manipulated. During this procedure, Office personnel must evaluate any statements of intended use or field of use, any data gathering step and any post-manipulation activity. See section IV.B.2(d) above for how to treat various types of claim language.

Only when the claim is devoid of any limitation to a practical application in the technological arts should it be rejected under § 101. Further, when such a rejection is made, Office personnel must expressly state how the language of the claims has been interpreted to support the rejection.

**V. Evaluate Application for Compliance with 35 U.S.C. § 112**

Office personnel should begin their evaluation of an application's compliance with § 112 by considering the requirements of § 112, second paragraph. The second paragraph contains two separate and distinct requirements: (1) that the

claim(s) set forth the subject matter applicants regard as the invention, and (2) that the claim(s) particularly point out and distinctly claim the invention. An application will be deficient under § 112, second paragraph when (1) evidence including admissions, other than in the application as filed, shows applicant has stated that he or she regards the invention to be different from what is claimed, or when (2) the scope of the claims is unclear.

After evaluation of the application for compliance with § 112, second paragraph, Office personnel should then evaluate the application for compliance with the requirements of § 112, first paragraph. The first paragraph contains three separate and distinct requirements: (1) adequate written description, (2) enablement, and (3) best mode. An application will be deficient under § 112, first paragraph when the written description is not adequate to identify what the applicant has invented, or when the disclosure does not enable one skilled in the art to make and use the invention as claimed without undue experimentation. Deficiencies related to disclosure of the best mode for carrying out the claimed invention are not usually encountered during examination of an application because evidence to support such a deficiency is seldom in the record.

If deficiencies are discovered with respect to § 112, Office personnel must be careful to apply the appropriate paragraph of § 112.

**A. Determine Whether the Claimed Invention Complies with 35 U.S.C. § 112, Second Paragraph Requirements**

**1. Claims Setting Forth the Subject Matter Applicant Regards as Invention**

Applicant's specification must conclude with claim(s) that set forth the subject matter which the applicant regards as the invention. The invention set forth in the claims is presumed to be that which applicant regards as the invention, unless applicant considers the invention to be something different from what has been claimed as shown by evidence, including admissions, outside the application as filed. An applicant may change what

he or she regards as the invention during the prosecution of the application.

## 2. Claims Particularly Pointing Out and Distinctly Claiming the Invention

Office personnel shall determine whether the claims set out and circumscribe the invention with a reasonable degree of precision and particularity. In this regard, the definiteness of the language must be analyzed, not in a vacuum, but always in light of the teachings of the disclosure as it would be interpreted by one of ordinary skill in the art. Applicant's claims, interpreted in light of the disclosure, must reasonably apprise a person of ordinary skill in the art of the invention. However, the applicant need not explicitly recite in the claims every feature of the invention. For example, if an applicant indicates that the invention is a particular computer, the claims do not have to recite every element or feature of the computer. In fact, it is preferable for claims to be drafted in a form that emphasizes what the applicant has invented (i.e., what is new rather than old).

A means plus function limitation is distinctly claimed if the description makes it clear that the means corresponds to well-defined structure of a computer or computer component implemented in either hardware or software and its associated hardware platform. Such means may be defined as:

- a programmed computer with a particular functionality implemented in hardware or hardware and software;
- a logic circuit or other component of a programmed computer that performs a series of specifically identified operations dictated by a computer program; or
- a computer memory encoded with executable instructions representing a computer program that can cause a computer to function in a particular fashion.

The scope of a "means" limitation is defined as the corresponding structure or material (e.g., a specific logic circuit) set forth in the written description and equivalents.<sup>65</sup> Thus, a claim using means plus function limitations without

corresponding disclosure of specific structures or materials that are not well-known fails to particularly point out and distinctly claim the invention. For example, if the applicant discloses only the functions to be performed and provides no express, implied or inherent disclosure of hardware or a combination of hardware and software that performs the functions, the application has not disclosed any "structure" which corresponds to the claimed means. Office personnel should reject such claims under § 112, second paragraph. The rejection shifts the burden to the applicant to describe at least one specific structure or material that corresponds to the claimed means in question, and to identify the precise location or locations in the specification where a description of at least one embodiment of that claimed means can be found. In contrast, if the corresponding structure is disclosed to be a memory or logic circuit that has been configured in some manner to perform that function (e.g., using a defined computer program), the application has disclosed "structure" which corresponds to the claimed means.

When a claim or part of a claim is defined in computer program code, whether in source or object code format, a person of skill in the art must be able to ascertain the metes and bounds of the claimed invention. In certain circumstances, as where self-documenting programming code is employed, use of programming language in a claim would be permissible because such program source code presents "sufficiently high-level language and descriptive identifiers" to make it universally understood to others in the art without the programmer having to insert any comments.<sup>66</sup> Applicants should be encouraged to functionally define the steps the computer will perform rather than simply reciting source or object code instructions.

**B. Determine Whether the Claimed Invention Complies with  
35 U.S.C. § 112, First Paragraph Requirements**

**1. Adequate Written Description**

The satisfaction of the enablement requirement does not satisfy the written description requirement.<sup>67</sup> For the written description requirement, an applicant's specification must reasonably convey to those skilled in the art that the applicant

was in possession of the claimed invention as of the date of invention. The claimed invention subject matter need not be described literally, i.e., using the same terms, in order for the disclosure to satisfy the description requirement.

## 2. Enabling Disclosure

An applicant's specification must enable a person skilled in the art to make and use the claimed invention without undue experimentation. The fact that experimentation is complex, however, will not make it undue if a person of skill in the art typically engages in such complex experimentation. For a computer-related invention, the disclosure must enable a skilled artisan to configure the computer to possess the requisite functionality, and, where applicable, interrelate the computer with other elements to yield the claimed invention, without the exercise of undue experimentation. The specification should disclose how to configure a computer to possess the requisite functionality or how to integrate the programmed computer with other elements of the invention, unless a skilled artisan would know how to do so without such disclosure.<sup>68</sup>

For many computer-related inventions, it is not unusual for the claimed invention to involve more than one field of technology. For such inventions, the disclosure must satisfy the enablement standard for each aspect of the invention.<sup>69</sup> As such, the disclosure must teach a person skilled in each art how to make and use the relevant aspect of the invention without undue experimentation. For example, to enable a claim to a programmed computer that determines and displays the three-dimensional structure of a chemical compound, the disclosure must

- enable a person skilled in the art of molecular modeling to understand and practice the underlying molecular modeling processes; and
- enable a person skilled in the art of computer programming to create a program that directs a computer to create and display the image representing the three-dimensional structure of the compound.

In other words, the disclosure corresponding to each aspect of the invention must be enabling to a person skilled in each respective art.

In many instances, an applicant will describe a programmed computer by outlining the significant elements of the programmed computer using a functional block diagram. Office personnel should review the specification to ensure that along with the functional block diagram the disclosure provides information that adequately describes each "element" in hardware or hardware and its associated software and how such elements are interrelated.<sup>70</sup>

**VI. Determine Whether the Claimed Invention Complies with  
35 U.S.C. §§ 102 and 103**

As is the case for inventions in any field of technology, assessment of a claimed computer-related invention for compliance with § 102 and § 103 begins with a comparison of the claimed subject matter to what is known in the prior art. If no differences are found between the claimed invention and the prior art, the claimed invention lacks novelty and is to be rejected by Office personnel under § 102. Once distinctions are identified between the claimed invention and the prior art, those distinctions must be assessed and resolved in light of the knowledge possessed by a person of ordinary skill in the art. Against this backdrop, one must determine whether the invention would have been obvious at the time the invention was made. If not, the claimed invention satisfies § 103. Factors and considerations dictated by law governing § 103 apply without modification to computer-related inventions.

If the difference between the prior art and the claimed invention is limited to descriptive material stored on or employed by a machine, Office personnel must determine whether the descriptive material is functional descriptive material or non-functional descriptive material, as described supra in Section IV. Functional descriptive material is a limitation in the claim and must be considered and addressed in assessing patentability under § 103. Thus, a rejection of the claim as a whole under § 103 is inappropriate unless the functional descriptive material would have been suggested by the prior art. Non-functional descriptive material cannot render non-obvious an invention that would have otherwise been obvious.<sup>71</sup>



Common situations involving non-functional descriptive material are:

- a computer-readable storage medium that differs from the prior art solely with respect to non-functional descriptive material, such as music or a literary work, encoded on the medium,
- a computer that differs from the prior art solely with respect to non-functional descriptive material that cannot alter how the machine functions (i.e., the descriptive material does not reconfigure the computer), or
- a process that differs from the prior art only with respect to non-functional descriptive material that cannot alter how the process steps are to be performed to achieve the utility of the invention.

Thus, if the prior art suggests storing a song on a disk, merely choosing a particular song to store on the disk would be presumed to be well within the level of ordinary skill in the art at the time the invention was made. The difference between the prior art and the claimed invention is simply a rearrangement of non-functional descriptive material.

#### **VII. Clearly Communicate Findings, Conclusions and Their Bases**

Once Office personnel have concluded the above analyses of the claimed invention under all the statutory provisions, including §§ 101, 112, 102 and 103, they should review all the proposed rejections and their bases to confirm their correctness. Only then should any rejection be imposed in an Office action. The Office action should clearly communicate the findings, conclusions and reasons which support them.

<sup>1</sup> These Guidelines are final and replace the *Proposed Examination Guidelines for Computer-Implemented Inventions*, 60 Fed. Reg. 28,778 (June 2, 1995) and the supporting legal analysis issued on October 3, 1995.

<sup>2</sup> "Computer-related inventions" include inventions implemented in a computer and inventions employing computer-readable media.

<sup>3</sup> *In re Abele*, 684 F.2d 902, 905-07, 214 USPQ 682, 685-87 (CCPA 1982); *In re Walter*, 618 F.2d 758, 767, 205 USPQ 397, 406-07 (CCPA 1980); *In re Freeman*, 573 F.2d 1237, 1245, 197 USPQ 464, 471 (CCPA 1978).

<sup>4</sup> See, e.g., *In re Toma*, 575 F.2d 872, 877-78, 197 USPQ 852, 857 (CCPA 1978); *In re Musgrave*, 431 F.2d 882, 893, 167 USPQ 280, 289-90 (CCPA 1970). See also *In re Schrader*, 22 F.3d 290, 297-98, 30 USPQ2d 1455, 1461-62 (Fed. Cir. 1994) (Newman, J., dissenting); *Paine, Webber, Jackson & Curtis, Inc. v. Merrill Lynch, Pierce, Fenner & Smith, Inc.*, 564 F. Supp. 1358, 1368-69, 218 USPQ 212, 220 (D. Del. 1983).

<sup>5</sup> As the courts have repeatedly reminded the Office: "The goal is to answer the question "'What did applicants invent?'" *Abele*, 684 F.2d at 907, 214 USPQ at 687. Accord, e.g., *Arrhythmia Research Tech. v. Corazonix Corp.*, 958 F.2d 1053, 1059, 22 USPQ2d 1033, 1038 (Fed. Cir. 1992).

<sup>6</sup> *Brenner v. Manson*, 383 U.S. 519, 528-36, 148 USPQ 689, 693-96 (1966); *In re Ziegler*, 992 F.2d 1197, 1200-03, 26 USPQ2d 1600, 1603-06 (Fed. Cir. 1993).

<sup>7</sup> See, e.g., *Musgrave*, 431 F.2d at 893, 167 USPQ at 289-90, cited with approval in *Schrader*, 22 F.3d at 297, 30 USPQ2d at 1461 (Newman, J., dissenting). The definition of "technology" is the "application of science and engineering to the development of machines and procedures in order to enhance or improve human conditions, or at least to improve human efficiency in some respect." *Computer Dictionary* 384 (Microsoft Press, 2d ed. 1994).

<sup>8</sup> E.g., *In re Alappat*, 33 F.3d 1526, 1543, 31 USPQ2d 1545, 1556-57 (Fed. Cir. 1994) (in banc) (quoting *Diamond v. Diehr*, 450 U.S. 175, 192, 209 USPQ 1, 10 (1981)). See also *id.* at 1569, 31 USPQ2d at 1578-79 (Newman, J., concurring) ("unpatentability of the principle does not defeat patentability of its practical

applications") (citing *O'Reilly v. Morse*, 56 U.S. (15 How.) 62, 114-19 (1854)); *Arrhythmia*, 958 F.2d at 1056, 22 USPQ2d at 1036; *Musgrave*, 431 F.2d at 893, 167 USPQ at 289-90 ("All that is necessary, in our view, to make a sequence of operational steps a statutory 'process' within 35 U.S.C. 101 is that it be in the technological arts so as to be in consonance with the Constitutional purpose to promote the progress of 'useful arts.' Const. Art. 1, sec. 8.").

<sup>9</sup> *Arrhythmia*, 958 F.2d at 1057, 22 USPQ2d at 1036:

It is of course true that a modern digital computer manipulates data, usually in binary form, by performing mathematical operations, such as addition, subtraction, multiplication, division, or bit shifting, on the data. But this is only how the computer does what it does. Of importance is the significance of the data and their manipulation in the real world, i.e., what the computer is doing.

<sup>10</sup> Many computer-related inventions do not consist solely of a computer. Thus, Office personnel should identify those claimed elements of the computer-related invention that are not part of the programmed computer, and determine how those elements relate to the programmed computer. Office personnel should look for specific information that explains the role of the programmed computer in the overall process or machine and how the programmed computer is to be integrated with the other elements of the apparatus or used in the process.

<sup>11</sup> Products may be either machines, manufactures or compositions of matter. Product claims are claims that are directed to either machines, manufactures or compositions of matter.

<sup>12</sup> Examples of language that may raise a question as to the limiting effect of the language in a claim:

- (a) statements of intended use or field of use,
- (b) "adapted to" or "adapted for" clauses,

- (c) "wherein" clauses, or
- (d) "whereby" clauses.

This list of examples is not intended to be exhaustive.

<sup>13</sup> *Markman v. Westview Instruments*, 52 F.3d 967, 980, 34 USPQ2d 1321, 1330 (Fed. Cir.) (in banc), cert. granted, 116 S. Ct. 40 (1995).

<sup>14</sup> See, e.g., *In re Paulsen*, 30 F.3d 1475, 1480, 31 USPQ2d 1671, 1674 (Fed. Cir. 1994) (inventor may define specific terms used to describe invention, but must do so "with reasonable clarity, deliberateness, and precision" and, if done, must "'set out his uncommon definition in some manner within the patent disclosure' so as to give one of ordinary skill in the art notice of the change" in meaning) (quoting *Intellicall, Inc. v. Phonometrics, Inc.*, 952 F.2d 1384, 1387-88, 21 USPQ2d 1383, 1386 (Fed. Cir. 1992)).

<sup>15</sup> *Id.* at 1480, 31 USPQ2d at 1674.

<sup>16</sup> See, e.g., *In re Zletz*, 893 F.2d 319, 321-22, 13 USPQ2d 1320, 1322 (Fed. Cir. 1989) ("During patent examination the pending claims must be interpreted as broadly as their terms reasonably allow. . . . The reason is simply that during patent prosecution when claims can be amended, ambiguities should be recognized, scope and breadth of language explored, and clarification imposed. . . . An essential purpose of patent examination is to fashion claims that are precise, clear, correct, and unambiguous. Only in this way can uncertainties of claim scope be removed, as much as possible, during the administrative process.").

<sup>17</sup> Two *in banc* decisions of the Federal Circuit have made clear that the Office is to interpret means plus function language according to 35 U.S.C. § 112, sixth paragraph. In the first, *In re Donaldson*, 16 F.3d 1189, 1193, 29 USPQ2d 1845, 1848 (Fed. Cir. 1994), the court held:

The plain and unambiguous meaning of paragraph six is that one construing means-plus-function language in a claim

must look to the specification and interpret that language in light of the corresponding structure, material, or acts described therein, and equivalents thereof, to the extent that the specification provides such disclosure.

Paragraph six does not state or even suggest that the PTO is exempt from this mandate, and there is no legislative history indicating that Congress intended that the PTO should be. Thus, this court must accept the plain and precise language of paragraph six.

Consistent with *Donaldson*, in the second decision, *Alappat*, 33 F.3d at 1540, 31 USPQ2d at 1554, the Federal Circuit held:

Given *Alappat*'s disclosure, it was error for the Board majority to interpret each of the means clauses in claim 15 so broadly as to "read on any and every means for performing the function" recited, as it said it was doing, and then to conclude that claim 15 is nothing more than a process claim wherein each means clause represents a step in that process. Contrary to suggestions by the Commissioner, this court's precedents do not support the Board's view that the particular apparatus claims at issue in this case may be viewed as nothing more than process claims.

<sup>18</sup> 1162 O.G. 59 (May 17, 1994).

<sup>19</sup> See, e.g., *Diamond v. Diehr*, 450 U.S. at 188-89, 209 USPQ at 9 ("In determining the eligibility of respondents' claimed process for patent protection under § 101, their claims must be considered as a whole. It is inappropriate to dissect the claims into old and new elements and then to ignore the presence of the old elements in the analysis. This is particularly true in a process claim because a new combination of steps in a process may be patentable even though all the constituents of the combination were well known and in common use before the combination was made.").

<sup>20</sup> See *supra* note 18 and accompanying text.

<sup>21</sup> *Diamond v. Chakrabarty*, 447 U.S. 303, 308-09, 206 USPQ 193, 197 (1980):

In choosing such expansive terms as "manufacture" and "composition of matter," modified by the comprehensive "any," Congress plainly contemplated that the patent laws would be given wide scope. The relevant legislative history also supports a broad construction. The Patent Act of 1793, authored by Thomas Jefferson, defined statutory subject matter as "any new and useful art, machine, manufacture, or composition of matter, or any new or useful improvement [thereof]." Act of Feb. 21, 1793, § 1, 1 Stat. 319. The Act embodied Jefferson's philosophy that "ingenuity should receive a liberal encouragement." 5 Writings of Thomas Jefferson 75-76 (Washington ed. 1871). See *Graham v. John Deere Co.*, 383 U.S. 1, 7-10 (1966). Subsequent patent statutes in 1836, 1870, and 1874 employed this same broad language. In 1952, when the patent laws were recodified, Congress replaced the word "art" with "process," but otherwise left Jefferson's language intact. The Committee Reports accompanying the 1952 Act inform us that Congress intended statutory subject matter to "include anything under the sun that is made by man." S. Rep. No. 1979, 82d Cong., 2d Sess. 5 (1952); H.R. Rep. No. 1923, 82d Cong., 2d Sess. 6 (1952).

This perspective has been embraced by the Federal Circuit:

The plain and unambiguous meaning of § 101 is that any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may be patented if it meets the requirements for patentability set forth in Title 35, such as those found in §§ 102, 103, and 112. The use of the expansive term "any" in § 101 represents Congress's intent not to place any restrictions on the subject matter for which a patent may be obtained beyond those specifically recited in § 101 and the other parts of Title 35. . . . Thus, it is improper to read into § 101 limitations as to the subject matter that may be patented where the legislative history does not

indicate that Congress clearly intended such limitations.  
[Alappat, 33 F.3d at 1542, 31 USPQ2d at 1556.]

<sup>22</sup> 35 U.S.C. § 101 (1994).

<sup>23</sup> See 35 U.S.C. § 100(b) ("The term 'process' means process, art, or method, and includes a new use of a known process, machine, manufacture, composition of matter, or material.").

<sup>24</sup> E.g., Alappat, 33 F.3d at 1542, 31 USPQ2d at 1556; *In re Warmerdam*, 33 F.3d 1354, 1358, 31 USPQ2d 1754, 1757 (Fed. Cir. 1994).

<sup>25</sup> See, e.g., *Rubber-Tip Pencil Co. v. Howard*, 87 U.S. 498, 507 (1874) ("idea of itself is not patentable, but a new device by which it may be made practically useful is"); *Mackay Radio & Telegraph Co. v. Radio Corp. of America*, 306 U.S. 86, 94 (1939) ("While a scientific truth, or the mathematical expression of it, is not patentable invention, a novel and useful structure created with the aid of knowledge of scientific truth may be."); *Warmerdam*, 33 F.3d at 1360, 31 USPQ2d at 1759 ("steps of 'locating' a medial axis, and 'creating' a bubble hierarchy . . . describe nothing more than the manipulation of basic mathematical constructs, the paradigmatic 'abstract idea'").

<sup>26</sup> The concern over preemption was expressed as early as 1852. See *Le Roy v. Tatham*, 55 U.S. 156, 175 (1852) ("A principle, in the abstract, is a fundamental truth; an original cause; a motive; these cannot be patented, as no one can claim in either of them an exclusive right."); *Funk Brothers Seed Co. v. Kalo Inoculant Co.*, 333 U.S. 127, 132, 76 USPQ 280, 282 (1948) (combination of six species of bacteria held to be non-statutory subject matter).

<sup>27</sup> The definition of "data structure" is "a physical or logical relationship among data elements, designed to support specific data manipulation functions." The New IEEE Standard Dictionary of Electrical and Electronics Terms 308 (5th ed. 1993).

<sup>28</sup> Compare *In re Lowry*, 32 F.3d 1579, 1583-84, 32 USPQ2d 1031, 1035 (Fed. Cir. 1994) (claim to data structure that increases computer efficiency held statutory) and *Warmerdam*, 33 F.3d at 1360-61, 31 USPQ2d at 1759 (claim to computer having specific memory held statutory product-by-process claim) with *Warmerdam*, 33 F.3d at 1361, 31 USPQ2d at 1760 (claim to a data structure per se held non-statutory).

<sup>29</sup> *In re Sarkar*, 588 F.2d 1330, 1333, 200 USPQ 132, 137 (CCPA 1978):

[E]ach invention must be evaluated as claimed; yet semantogenic considerations preclude a determination based solely on words appearing in the claims. In the final analysis under § 101, the claimed invention, as a whole, must be evaluated for what it is.

Quoted with approval in *Abele*, 684 F.2d at 907, 214 USPQ at 687. See also *In re Johnson*, 589 F.2d 1070, 1077, 200 USPQ 199, 206 (CCPA 1978) ("form of the claim is often an exercise in drafting").

<sup>30</sup> See, e.g., *Warmerdam*, 33 F.3d at 1361, 31 USPQ2d at 1760 (claim to a data structure per se held non-statutory).

<sup>31</sup> Computer Dictionary 210 (Microsoft Press, 2d ed. 1994):

Data consists of facts, which become information when they are seen in context and convey meaning to people. Computers process data without any understanding of what that data represents.

<sup>32</sup> See *supra* note 29.

<sup>33</sup> *O'Reilly v. Morse*, 56 U.S. (15 How.) at 112-14.

<sup>34</sup> *Id.* at 114-19.

<sup>35</sup> Products may be either machines, manufactures or compositions of matter.



A machine is:

a concrete thing, consisting of parts or of certain devices and combinations of devices.

*Burr v. Duryee*, 68 U.S. (1 Wall.) 531, 570 (1863).

A manufacture is:

the production of articles for use from raw or prepared materials by giving to these materials new forms, qualities, properties or combinations, whether by hand-labor or by machinery.

*Diamond v. Chakrabarty*, 447 U.S. at 308, 206 USPQ at 196-97 (quoting *American Fruit Growers, Inc. v. Brogdex Co.*, 283 U.S. 1, 11 (1931)).

A composition of matter is:

a composition[] of two or more substances [or] . . . a[] composite article[], whether . . . [it] be the result of chemical union, or of mechanical mixture, whether . . . [it] be [a] gas[], fluid[], powder[], or solid[].

*Diamond v. Chakrabarty*, 447 U.S. at 308, 206 USPQ at 197 (quoting *Shell Development Co. v. Watson*, 149 F. Supp. 279, 280, 113 USPQ 265, 266 (D.D.C. 1957), *aff'd per curiam*, 252 F.2d 861, 116 USPQ 428 (D.C. Cir. 1958)).

<sup>36</sup> See, e.g., *Lowry*, 32 F.3d at 1583, 32 USPQ2d at 1034-35; *Warmerdam*, 33 F.3d at 1361-62, 31 USPQ2d at 1760.

<sup>37</sup> Cf. *In re Iwahashi*, 888 F.2d 1370, 1374-75, 12 USPQ2d 1908, 1911-12 (Fed. Cir. 1989), cited with approval in *Alappat*, 33 F.3d at 1544 n.24, 31 USPQ2d at 1558 n.24.

<sup>38</sup> "Specific software" is defined as a set of instructions implemented in a specific program code segment. See *Computer*

Dictionary 78 (Microsoft Press, 2d ed. 1994) for definition of "code segment."

<sup>39</sup> See *Diamond v. Diehr*, 450 U.S. at 183-84, 209 USPQ at 6 (quoting *Cochrane v. Deener*, 94 U.S. 780, 787-88 (1877) ("A [statutory] process is a mode of treatment of certain materials to produce a given result. It is an act, or a series of acts, performed upon the subject-matter to be transformed and reduced to a different state or thing. . . . The process requires that certain things should be done with certain substances, and in a certain order; but the tools to be used in doing this may be of secondary consequence.")).

<sup>40</sup> See *Alappat*, 33 F.3d at 1543, 31 USPQ2d at 1556-57 (quoting *Diamond v. Diehr*, 450 U.S. at 192, 209 USPQ at 10). See also *id.* at 1569, 31 USPQ2d at 1578-79 (Newman, J., concurring) ("unpatentability of the principle does not defeat patentability of its practical applications") (citing *O'Reilly v. Morse*, 56 U.S. (15 How.) at 114-19).

<sup>41</sup> *Diamond v. Diehr*, 450 U.S. at 187, 209 USPQ at 8.

<sup>42</sup> See *In re Gelnovatch*, 595 F.2d 32, 41 n.7, 201 USPQ 136, 145 n.7 (CCPA 1979) (data-gathering step did not measure physical phenomenon).

<sup>43</sup> *Schrader*, 22 F.3d at 294, 30 USPQ2d at 1459 citing with approval *Arrhythmia*, 958 F.2d at 1058-59, 22 USPQ2d at 1037-38; *Abele*, 684 F.2d at 909, 214 USPQ at 688; *In re Taner*, 681 F.2d 787, 790, 214 USPQ 678, 681 (CCPA 1982).

<sup>44</sup> See *supra* note 9.

<sup>45</sup> In *Sarkar*, 588 F.2d at 1335, 200 USPQ at 139, the court explained why this approach must be followed:

No mathematical equation can be used, as a practical matter, without establishing and substituting values for the variables expressed therein. Substitution of values dictated by the formula has thus been viewed as a form of mathematical step. If the steps of gathering and

substituting values were alone sufficient, every mathematical equation, formula, or algorithm having any practical use would be per se subject to patenting as a "process" under § 101. Consideration of whether the substitution of specific values is enough to convert the disembodied ideas present in the formula into an embodiment of those ideas, or into an application of the formula, is foreclosed by the current state of the law.

<sup>46</sup> See *supra* note 40.

<sup>47</sup> See, e.g., *In re Bernhart*, 417 F.2d 1395, 1400, 163 USPQ 611, 616 (CCPA 1969).

<sup>48</sup> *Schrader*, 22 F.3d at 293-94, 30 USPQ2d at 1458-59.

<sup>49</sup> *Warmerdam*, 33 F.3d at 1360, 31 USPQ2d at 1759.

<sup>50</sup> See, e.g., *In re Meyer*, 688 F.2d 789, 794-95, 215 USPQ 193, 197 (CCPA 1982) ("Scientific principles, such as the relationship between mass and energy, and laws of nature, such as the acceleration of gravity, namely,  $a=32 \text{ ft./sec.}^2$ , can be represented in mathematical format. However, some mathematical algorithms and formulae do not represent scientific principles or laws of nature; they represent ideas or mental processes and are simply logical vehicles for communicating possible solutions to complex problems. The presence of a mathematical algorithm or formula in a claim is merely an indication that a scientific principle, law of nature, idea or mental process may be the subject matter claimed and, thus, justify a rejection of that claim under 35 USC § 101; but the presence of a mathematical algorithm or formula is only a signpost for further analysis.").

*Cf. Alappat*, 33 F.3d at 1543 n.19, 31 USPQ2d at 1556 n.19 in which the Federal Circuit recognized the confusion:

The Supreme Court has not been clear . . . as to whether such subject matter is excluded from the scope of § 101 because it represents laws of nature, natural phenomena, or abstract ideas. See *Diehr*, 450 U.S. at 186 (viewed mathematical algorithm as a law of nature); *Benson*, 409 U.S. at 71-72 (treated mathematical algorithm as an

"idea"). The Supreme Court also has not been clear as to exactly what kind of mathematical subject matter may not be patented. The Supreme Court has used, among others, the terms "mathematical algorithm," "mathematical formula," and "mathematical equation" to describe types of mathematical subject matter not entitled to patent protection standing alone. The Supreme Court has not set forth, however, any consistent or clear explanation of what it intended by such terms or how these terms are related, if at all.

<sup>51</sup> *Walter*, 618 F.2d at 769, 205 USPQ at 409 (Because none of the claimed steps were explicitly or implicitly limited to their application in seismic prospecting activities, the court held that "[a]lthough the claim preambles relate the claimed invention to the art of seismic prospecting, the claims themselves are not drawn to methods of or apparatus for seismic prospecting; they are drawn to improved mathematical methods for interpreting the results of seismic prospecting."). Cf. *Alappat*, 33 F.3d at 1544, 31 USPQ2d at 1558.

<sup>52</sup> *Walter*, 618 F.2d at 769-70, 205 USPQ at 409.

<sup>53</sup> See *supra* note 45.

<sup>54</sup> *Taner*, 681 F.2d at 788, 214 USPQ at 679.

<sup>55</sup> *Abele*, 684 F.2d at 908, 214 USPQ at 687 ("The specification indicates that such attenuation data is available only when an X-ray beam is produced by a CAT scanner, passed through an object, and detected upon its exit. Only after these steps have been completed is the algorithm performed, and the resultant modified data displayed in the required format.").

<sup>56</sup> *Gelnovatch*, 595 F.2d at 41 n.7, 201 USPQ at 145 n.7 ("Appellants' claimed step of perturbing the values of a set of process inputs (step 3), in addition to being a mathematical operation, appears to be a data-gathering step of the type we have held insufficient to change a nonstatutory method of calculation into a statutory process. . . . In this instance, the perturbed process inputs are not even measured values of

physical phenomena, but are instead derived by numerically changing the values in the previous set of process inputs.").

<sup>57</sup> *Sarkar*, 588 F.2d at 1331, 200 USPQ at 135.

<sup>58</sup> See *Sarkar*, 588 F.2d at 1332 n.6, 200 USPQ at 136 n.6 ("post-solution" construction that was being modeled by the mathematical process not considered in deciding § 101 question because applicant indicated that such construction was not a material element of the invention).

<sup>59</sup> *Parker v. Flook*, 437 U.S. 584, 585, 198 USPQ 193, 195 (1978).

<sup>60</sup> *Walter*, 618 F.2d at 770, 205 USPQ at 409 ("If § 101 could be satisfied by the mere recordation of the results of a nonstatutory process on some record medium, even the most unskilled patent draftsman could provide for such a step.").

<sup>61</sup> *Gelnovatch*, 595 F.2d at 41 n.7, 201 USPQ at 145 n.7.

<sup>62</sup> *Abele*, 684 F.2d at 909, 214 USPQ at 688 ("This claim presents no more than the calculation of a number and display of the result, albeit in a particular format. The specification provides no greater meaning to 'data in a field' than a matrix of numbers regardless of by what method generated. Thus, the algorithm is neither explicitly nor implicitly applied to any certain process. Moreover, that the result is displayed as a shade of gray rather than as simply a number provides no greater or better information, considering the broad range of applications encompassed by the claim.").

<sup>63</sup> *In re De Castelet*, 562 F.2d 1236, 1244, 195 USPQ 439, 446 (CCPA 1977) ("That the computer is instructed to transmit electrical signals, representing the results of its calculations, does not constitute the type of 'post solution activity' found in *Flook*, [437 U.S. 584, 198 USPQ 193 (1978)], and does not transform the claim into one for a process merely using an algorithm. The final transmitting step constitutes nothing more than reading out the result of the calculations.").

<sup>64</sup> E.g., *Warmerdam*, 33 F.3d at 1360, 31 USPQ2d at 1759. See also *Schrader*, 22 F.3d at 295, 30 USPQ2d at 1459.

<sup>65</sup> See *supra* note 18 and accompanying text.

<sup>66</sup> Computer Dictionary 353 (Microsoft Press, 2d ed. 1994) (definition of "self-documenting code").

<sup>67</sup> See *In re Barker*, 559 F.2d 588, 591, 194 USPQ 470, 472 (CCPA 1977), cert. denied, *Barker v. Parker*, 434 U.S. 1064 (1978) (a specification may be sufficient to enable one skilled in the art to make and use the invention, but still fail to comply with the written description requirement). See also *In re DiLeone*, 436 F.2d 1404, 1405, 168 USPQ 592, 593 (CCPA 1971).

<sup>68</sup> See, e.g., *Northern Telecom v. Datapoint Corp.*, 908 F.2d 931, 941-43, 15 USPQ2d 1321, 1328-30 (Fed. Cir.), cert. denied, *Datapoint Corp. v. Northern Telecom*, 498 U.S. 920 (1990) (judgment of invalidity reversed for clear error where expert testimony on both sides showed that a programmer of reasonable skill could write a satisfactory program with ordinary effort based on the disclosure); *DeGeorge v. Bernier*, 768 F.2d 1318, 1324, 226 USPQ 758, 762-63 (Fed. Cir. 1985) (superseded by statute with respect to issues not relevant here) (invention was adequately disclosed for purposes of enablement even though all of the circuitry of a word processor was not disclosed, since the undisclosed circuitry was deemed inconsequential because it did not pertain to the claimed circuit); *In re Phillips*, 608 F.2d 879, 882-83, 203 USPQ 971, 975 (CCPA 1979) (computerized method of generating printed architectural specifications dependent on use of glossary of predefined standard phrases and error-checking feature enabled by overall disclosure generally defining errors); *In re Donohue*, 550 F.2d 1269, 1271, 193 USPQ 136, 137 (CCPA 1977) ("Employment of block diagrams and descriptions of their functions is not fatal under 35 U.S.C. § 112, first paragraph, providing the represented structure is conventional and can be determined without undue experimentation."); *In re Knowlton*, 481 F.2d 1357, 1366-68, 178 USPQ 486, 493-94 (CCPA 1973) (examiner's contention that a software invention needed a detailed

description of all the circuitry in the complete hardware system reversed).

<sup>69</sup> See *In re Naquin*, 398 F.2d 863, 866, 158 USPQ 317, 319 (CCPA 1968) ("When an invention, in its different aspects, involves distinct arts, that specification is adequate which enables the adepts of each art, those who have the best chance of being enabled, to carry out the aspect proper to their specialty."); *Ex parte Zechnall*, 194 USPQ 461, 461 (Bd. App. 1973) ("appellants' disclosure must be held sufficient if it would enable a person skilled in the electronic computer art, in cooperation with a person skilled in the fuel injection art, to make and use appellants' invention").

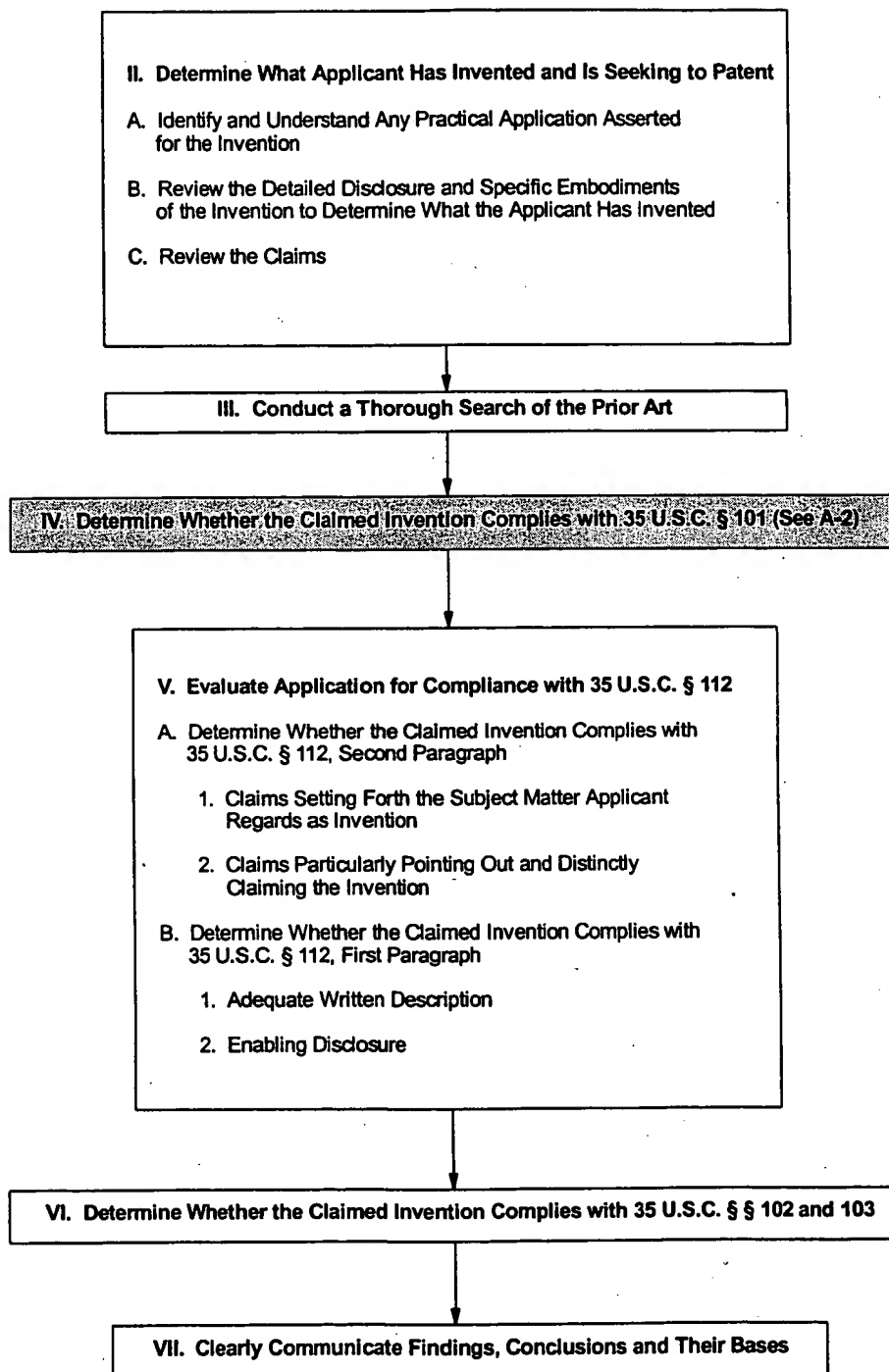
<sup>70</sup> See *In re Scarbrough*, 500 F.2d 560, 565, 182 USPQ 298, 301-02 (CCPA 1974) ("It is not enough that a person skilled in the art, by carrying on investigations along the line indicated in the instant application, and by a great amount of work eventually might find out how to make and use the instant invention. The statute requires the application itself to inform, not to direct others to find out for themselves (citation omitted)."); *Knowlton*, 481 F.2d at 1367, 178 USPQ at 493 (disclosure must constitute more than a "sketchy explanation of flow diagrams or a bare group of program listings together with a reference to a proprietary computer on which they might be run"). See also *In re Gunn*, 537 F.2d 1123, 1127-28, 190 USPQ 402, 405 (CCPA 1976); *In re Brandstadter*, 484 F.2d 1395, 1406-07, 17 USPQ 286, 294 (CCPA 1973); and *In re Ghiron*, 442 F.2d 985, 991, 169 USPQ 723, 727-28 (CCPA 1971).

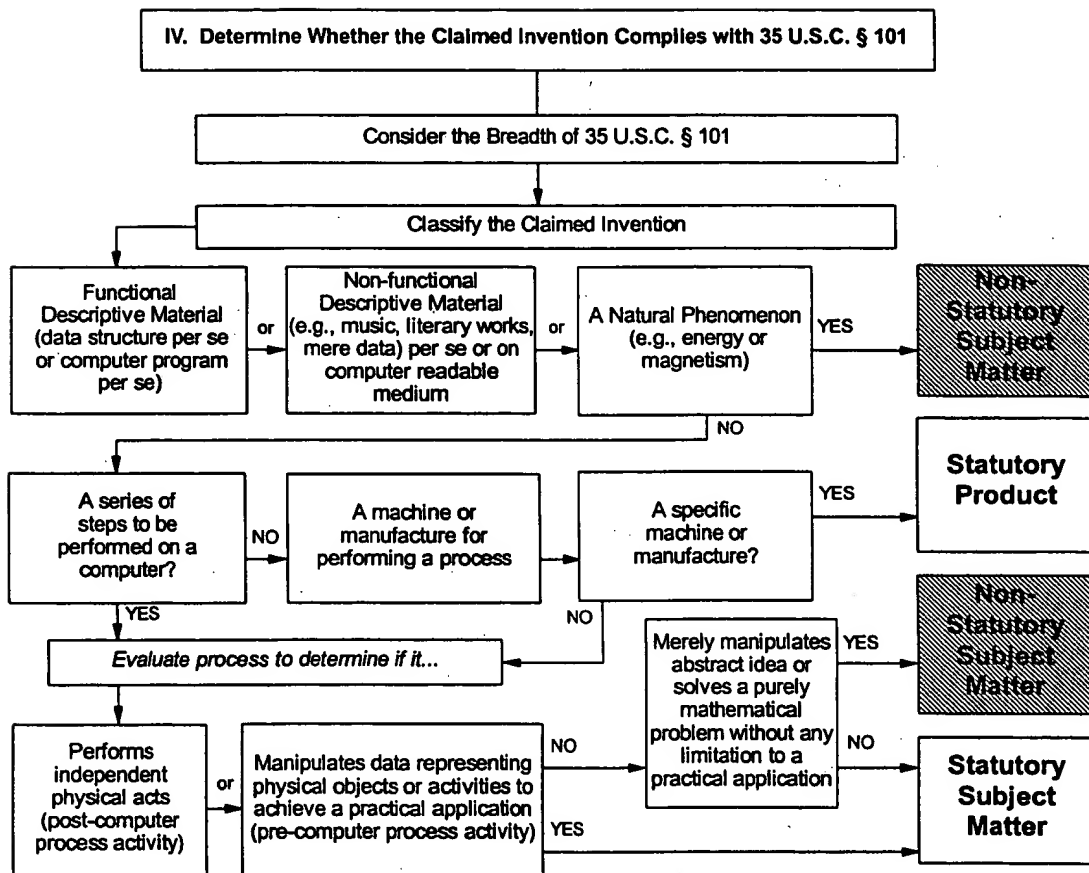
<sup>71</sup> Cf. *In re Gulack*, 703 F.2d 1381, 1385, 217 USPQ 401, 404 (Fed. Cir. 1983) (when descriptive material is not functionally related to the substrate, the descriptive material will not distinguish the invention from the prior art in terms of patentability).

APPENDIX



## Computer-Related Inventions





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